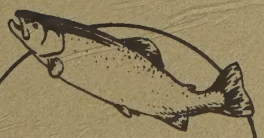
Central North Pacific Albacore Surveys May to November 1955



SPECIAL SCIENTIFIC REPORT---FISHERIES No. 212

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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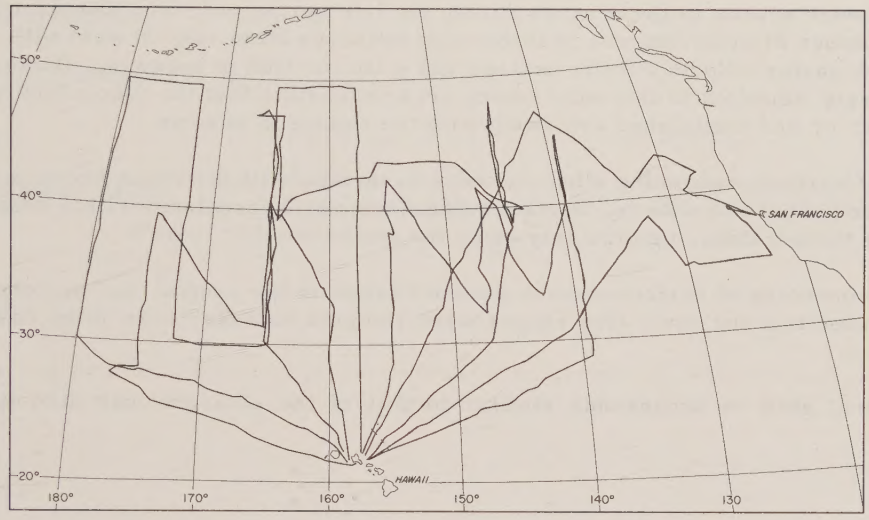

CENTRAL NORTH PACIFIC ALBACORE SURVEYS, MAY TO NOVEMBER 1955

By

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Special Scientific Report--Fisheries No. 212

WASHINGTON: April 1957

ABSTRACT

Five cruises were completed by Pacific Oceanic Fishery Investigations during May-November, 1955, to investigate the albacore tuna, Germo alalunga (Bonnaterre), resources to the north and northeast of the Hawaiian Islands.

Albacore were scarce in these areas during the late spring and were abundant during the late summer. The summer distribution was probably discontinuous from east to west with concentrations in the central and eastern North Pacific sectors and a lack of fish in between. During the fall albacore were relatively abundant in this intervening area suggesting that the discontinuity was either a transient condition or had diminished somewhat with the change in season.

Catches of surface-swimming albacore were associated with the Polar Front, a transition zone between central and subarctic waters. Surface catches were also associated with a seasonal latitudinal change in surface temperature, particularly about the isotherms 55° to 65°F.

Length frequencies of surface-caught albacore taken in the central and eastern sectors of the North Pacific showed that the same size ranges were sampled on either side of the east-west discontinuity noted above.

A latitudinal shift in occurrence similar to that of the albacore was also displayed by other fishes.

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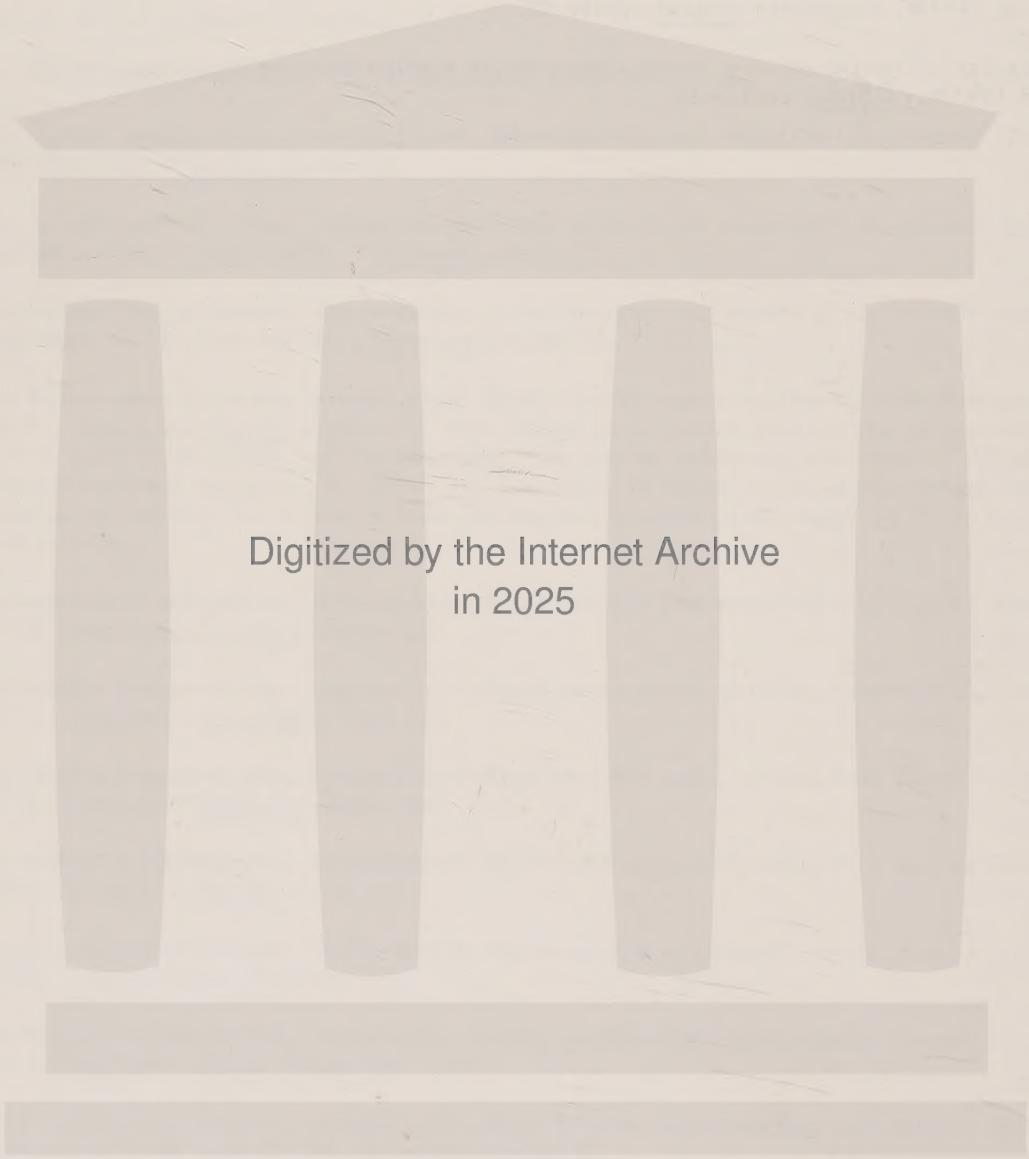

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The Pacific Oceanic Fishery Investigations (POFI) of the U. S. Fish and Wildlife Service is conducting a comprehensive study of the resources of the albacore tuna, Germo alalunga (Bonnaterre), north and northeast of the Hawaiian Islands under Public Laws 329 and 466 (the latter known as the Saltonstall-Kennedy Act). This investigation is primarily concerned with the distribution and abundance of albacore with a view to commercial exploitation and is supported by biological and oceanographic studies. To date, 11 cruises, 8 exploratory fishing and 3 oceanographic, have been completed; the results of 6 of these cruises in 1954-55 have been described (Shomura and Otsu 1956). This report will deal primarily with the fishing results obtained from the remaining 5 cruises completed during 1955. The general cruise periods and areas of operation are given in table 1.

The 5 cruises were undertaken by the research vessels Hugh M. Smith, John R. Manning, and Charles H. Gilbert under the command of Barnes Collinson, Fred E. Barnett, and William T. Tanaka respectively. The scientific data were collected by or under the direction of Field Party Chiefs Richard S. Shomura (Smith 29 and Gilbert 23), Tamio Otsu (Manning 26), Wilvan G. Van Campen (Manning 25), and James W. McGary (Smith 30). I wish to acknowledge the sincere efforts of the captains, crews, and scientists in making these data available.

The area under investigation by POFI lies between two important North Pacific albacore fisheries. The Japanese longline fishery extends from the coast of Japan to the vicinity of Midway Island (Suda 1954) and fishes for deep-swimming albacore. The North American trolling fishery has its nucleus along the coast of southern California (Clemens 1955) and fishes for surface-swimming albacore. To insure adequate vertical as well as horizontal sampling of albacore in the area between these two fisheries, POFI has employed both longlines and surface trolling gear. Surface gill netting has also been undertaken to a limited extent.

MATERIALS AND METHODS

A detailed description of POFI albacore longline gear has been presented by Mann (1955) and Shomura and Otsu (1956). Briefly, the basic unit, or "basket," of gear is composed of 210 fathoms of mainline to which floats are attached at either end. Droppers 3 fathoms long are suspended from this mainline at intervals of 15 fathoms. Wire leaders and hooks are attached to the droppers. POFI longline sets during the above cruises consisted of 40 baskets of gear, with 13 hooks per basket. To secure a wide vertical range over the entire horizontal range of sampling, 5- and 15-fathom floatlines were alternated in groups of 10 baskets. The former were set taut and the latter at normal slack. Sets were made at daybreak (0500) and hauling commenced at noon. Setting required approximately 1 hour and hauling 3 to 4 hours, allowing a fishing time of roughly 6 hours.

The maximum depth fished by baskets in several parts of the set and the symmetry of individual baskets were measured by the use of sounding tubes as described by Shomura and

Table 1.--POFI cruises investigating albacore tuna resources in the North Pacific, 1955

Cruise	Activity	Period of operation	General area covered	
			N. latitude	W. longitude
Manning 25	Albacore surveys	5/2 -6/7	23° - 42°	157° - 176°
Smith 29	do	5/2 -6/4	20° - 46°	139° - 157°
Manning 26	do	7/15-9/10	29° - 48°	122° - 153°
Smith 30	Hydrographic (NORPAC)	7/15-8/28	20° - 50°	155° - 180°
Gilbert 23	Albacore surveys	9/15-11/2	21° - 48°	145° - 165°

Otsu (1956). Tubes were placed on dropper 7 (the middle dropper) in baskets 5, 15, and 35, Manning (cruise 25); in baskets 5, 15, 26, and 35, Smith (cruise 29) and Manning (cruise 26). An extra basket bearing sounding tubes on droppers 4, 7, and 10 was placed between baskets 25 and 26 on all longline cruises. During the Gilbert's cruise 23, extra baskets with tubes on droppers 4, 7, and 10 were placed between baskets 5 and 6, 15 and 16, 25 and 26, and 35 and 36. Droppers bearing sounding tubes and all droppers in extra baskets were hookless. This to some extent prevented excessively deep readings due to the diving of captured fish.

Trolling was done usually with 5 to 8 lines bearing varieties of feathered, bone, and plastic jigs (Shomura and Otsu 1956). Trolling speeds varied from about 6 to 9 knots. When in waters believed to contain albacore, trolling was confined to speeds of 6 to 7 knots. This general range of speed is thought to be optimum (Powell et al. 1952) for catching albacore on trolling gear. In addition to trolling on the runs between longline and gill-net stations, 2 hours were devoted to trolling on each longline station, but little or no time was devoted to circling and "working" productive areas. All trolling was carried out during daylight.

Gill nets were used experimentally during cruise 23 of the Gilbert as a supplement to surface trolling. Their use was prompted by the relatively good catches of albacore made by the Pacific Salmon Investigations (PSI) of the Fish and Wildlife Service (Tester 1956). These catches were made in salmon gill nets set in the general area under investigation by POFI. POFI's gear consisted of 6 shackles, each 300 fathoms long and 100 meshes deep. A set was composed of 2 shackles each of 5-, 6-, and 7-inch (stretched measure) mesh nets. The nets were set at dusk and hauled at daybreak.

DISTRIBUTION AND ABUNDANCE

The Manning (cruise 25) and the Smith (cruise 29) explored the late spring distribution and abundance of albacore between 176°W. and 139°W. longitude (fig. 1). Surface-swimming albacore were scarce in the area surveyed. A single albacore was taken on each cruise or less than 1 fish per 100 line hours' trolling at speeds of 6 to 7 knots (table 2).

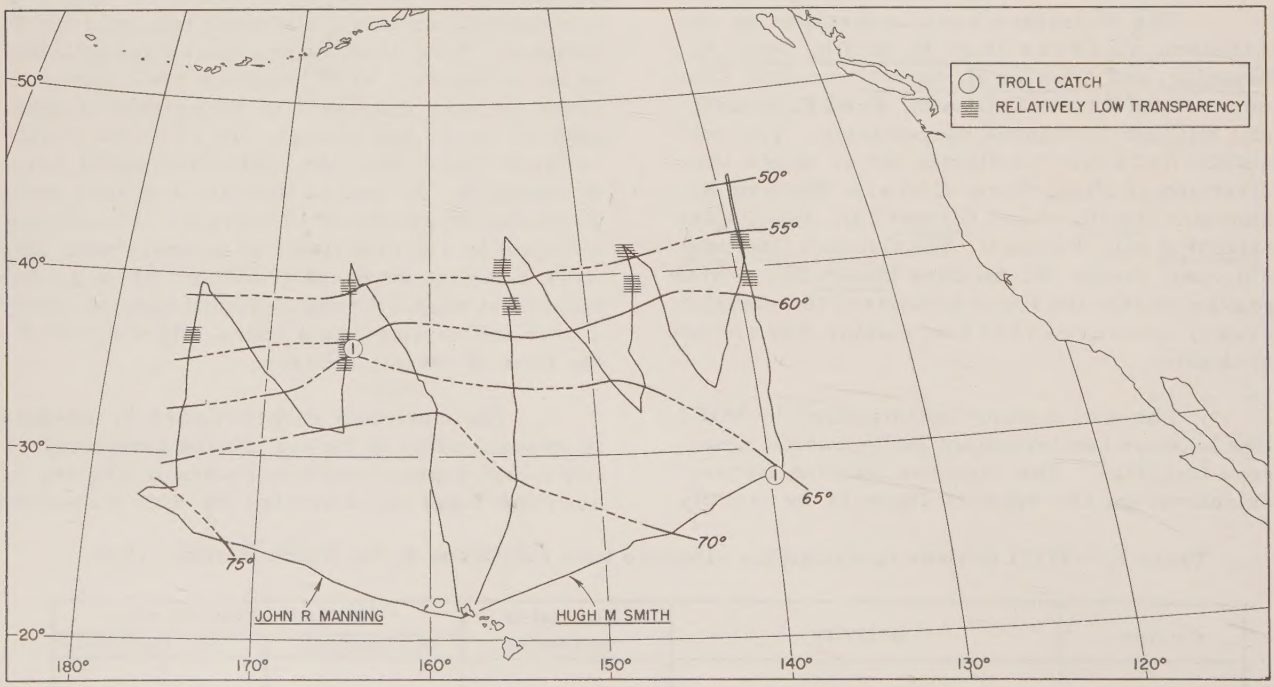

Figure 1.--Spring cruises of the John R. Manning (cruise 25), May 2-June 7, 1955, and the Hugh M. Smith (cruise 29), May 2-June 4, 1955. Tracks of each cruise are shown together with surface temperature (°F.) and the distribution of water of relatively low transparency, in relation to surface albacore catches.

Table 2.--Trolling effort and albacore catches

Cruise	Line hours		Albacore catch per 100 hours' trolling		Total albacore taken
	Speeds				
	6-7 knots	Other	6-7 knots	Other	
Manning 25	1,308	153.5	0.1	0	1
Manning 26	1,713	453	3.7	0	64
Smith 29	1,665	51	0.1	0	1
Smith 30	205	1,583.5	2.9	0.1	7
Gilbert 23	2,735	613	2.3	0	64

An unidentified school, which may have been albacore, was observed at the surface by the Smith (cruise 29) at 37°41'N. latitude, 154°54'W. longitude, well within the so-called "albacore water" with which troll catches have been associated (Shomura and Otsu 1956).

No deep-swimming albacore were taken on either of the spring POFI longline cruises (fig. 1). During May-June, 1955, 3 albacore were captured by the N. B. Scofield (Anonymous 1955) of the California Department of Fish and Game on longline gear at 28°N. and 29°N. latitude, 135°W. longitude, approximately 210 miles east of where the Smith took a single surface-swimming albacore by trolling. The Scofield surveyed the area roughly from the easternmost leg of the Smith's cruise 29 to the Pacific coast, i.e., from 26°N. to 36°N. latitude and 135°W. to 177°W. longitude.

During the late summer, albacore are caught commercially along the coast from San Francisco (38°N. latitude) to the central portion (27°N. latitude) of Baja California, and as far offshore as 125°W. longitude (Clemens 1955). The results of the Manning's survey (cruise 26) in the late summer of 1955 appeared to extend this productive ground (see outlined area, fig. 2) to the northwest into an area not presently

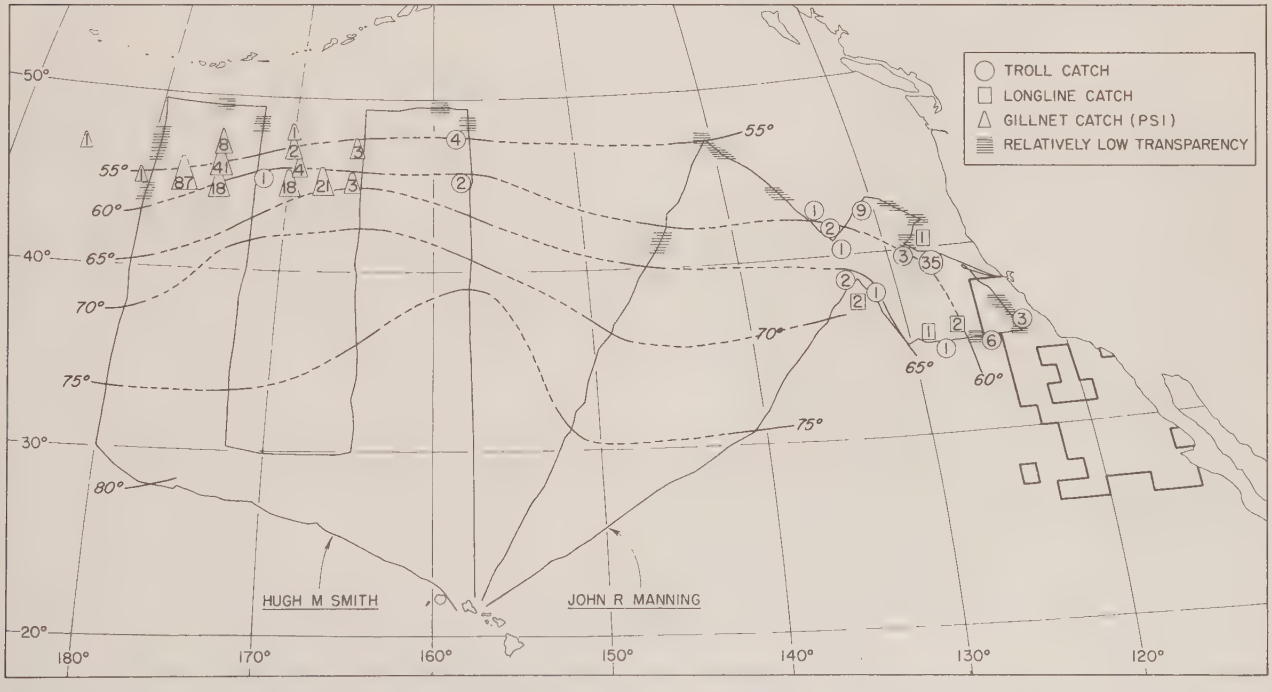

Figure 2.--Summer cruises of the John R. Manning (cruise 26), July 15-September 10, 1955, and the Hugh M. Smith (cruise 30), July 15-August 28, 1955. The track of each cruise is shown together with surface temperature (°F.) and the distribution of water of relatively low transparency, in relation to surface and subsurface albacore catches. The general area of the California albacore fishery for the months of July and August 1951-53 combined is outlined (Clemens 1955).

supporting a commercial fishery. On August 12, 35 albacore were landed by trolling gear during 12 hours of fishing, for a catch rate of 4.9 fish per 100 line hours; an additional 18 fish were hooked and lost. To the westward catches diminished, no albacore being taken by the Manning west of 135°W. longitude. Farther westward, beyond 155°W., the Smith took 7 fish, suggesting that there was perhaps a discontinuous distribution of surface-swimming albacore in the central and eastern Pacific during the summer months.

While the Smith's catch was small, table 2 shows that of 1,788 line hours fished only 205 were at 6 to 7 knots. At these optimum trolling speeds the catch was 2.9 fish per 100 line hours, which is comparable with that of the Manning (cruise 26). In addition, the findings of the Smith were supported by catches taken in salmon gill nets operated within the same area and period by the vessels Mitkof and Paragon (Tester 1956) chartered by the Pacific Salmon Investigations. Figure 2 shows that albacore were taken at the surface in the western section fished by the Smith and also as far west as 175°E. longitude. The largest catch was 87 fish at 45°N. latitude, 177°W. longitude.

During the late summer, longline fishing for albacore was done only by the Manning (cruise 26). Figure 2 shows the positions at which the total catch of 6 albacore was taken. Their distribution was similar to the Manning's surface catch in that they were made to the east of 135°W. longitude, but not to the west.

Possibly, the discontinuity in albacore distribution noted during the late summer was either transient or had diminished somewhat when the Gilbert (cruise 23) surveyed the area between 145°W. and 165°W. longitude northeast of the Hawaiian Islands. Figure 3 shows that fish were taken by the Gilbert in greatest numbers when trolling along longitude 145°W. and at about 42.5°N. latitude, 148°W. longitude. The Gilbert sighted an albacore school at 45°N. latitude, 145°W. longitude, slightly north of the position where the largest troll catch was made. Albacore were not encountered between 148°W. and 165°W. longitude. Stormy weather prevented an adequate assessment of surface-swimming albacore between these longitudes. The Mitkof of the Pacific Salmon Investigations took a single albacore in a salmon gill net at 145°W. longitude, 48°N. latitude (fig. 3) in about the same period (September) as the Gilbert's cruise, but none was taken along 155°W. longitude, where the Mitkof occupied stations on 49°, 50°, and 51°N. latitude. However, we would not expect albacore to occur at these latitudes because of the low surface temperatures.

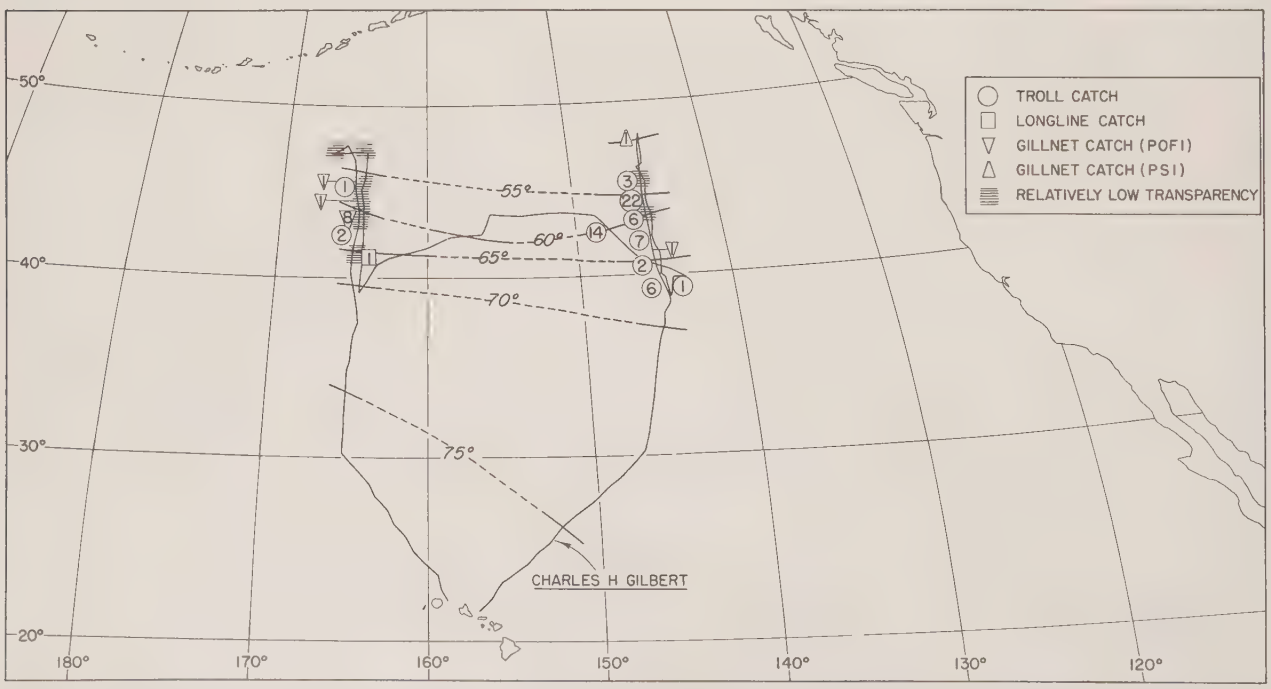

Figure 3.--Fall cruise of the Charles H. Gilbert (cruise 23), September 15-November 2, 1955. The track of the cruise is shown together with surface temperature (°F.) and the distribution of water of relatively low transparency, in relation to surface and subsurface albacore catches.

Gill nets were employed successfully by the Gilbert (cruise 23) on the first leg of the cruise, on 165°W. longitude, but their use was restricted by bad weather on the second leg, on 145°W. longitude (fig. 3). Of four catches made only one contained more than a single albacore and this consisted of 8 fish taken at 43°22'N. latitude, 164°40'W. longitude. All of the fish except one were properly gilled in the nets. Bad weather also restricted longlining on the second leg of the cruise, allowing only 3 sets; all were either north or south of what is considered "albacore water." A single deep-swimming albacore was taken at 41°40'N. latitude, 164°29'W. longitude (fig. 3).

Briefly, within the areas surveyed (table 1, figs. 1, 2, and 3) albacore were scarce in the central and eastern North Pacific during the late spring and were abundant during the late summer. The summer distribution was probably discontinuous, with concentrations in the central and eastern North Pacific sectors and a lack of fish in between. During the fall albacore were relatively abundant in this intervening area, suggesting that the discontinuity was either a transient condition or had diminished somewhat with the change in season.

ENVIRONMENTAL CONDITIONS

The association of albacore catches with the Polar Front has been reported by Shomura and Otsu (1956). This boundary or transition zone between central and subarctic waters is probably a more or less constant source of enrichment to the surface waters (McGary and Stroup 1956) as indicated by the occurrence of relatively high concentrations of dissolved inorganic phosphate. The relatively low transparency of the surface waters may be evidence of increased biological productivity. Superimposed on the Polar Front is a seasonal latitudinal change in surface temperature. Previous results (Shomura and Otsu 1956) and those reported below suggest that the movements of surface albacore are coordinated with this shift in temperature, particularly about isotherm 55°F. to 65°F.

Figures 1, 2, and 3 show that albacore taken at the surface during the spring, summer, and fall cruises were clustered about isotherms 55°F. to 65°F. and, especially during the latter two seasons, were within or adjacent to areas of relatively low transparency. In the spring, the Manning (cruise 25) took a single albacore along the 65°F. isotherm at 35°38'N. latitude, 165°W. longitude, and the Smith (cruise 29) also took one along the same isotherm, but at a more southerly latitude, 28°56'N., 139°07'W. longitude. The latter catch was considerably south of the areas of low transparency. Summer catches showed a much closer association with the Polar Front in that they were within or adjoining areas of relatively low transparency. To the west of 155°W. longitude the front extends roughly east and west in a narrow band, but east of this longitude the front curves southeast and loses much of its continuity. A positive association of albacore surface catches and the Polar Front is suggested in this instance since catches to the west of 155°W. longitude were made within a narrow range of latitude, while those to the east showed an extended distribution. Fall conditions with a drop in surface temperature set in during cruise 23 of the Gilbert; albacore were taken roughly between latitudes 42°30'N. and 46°00'N. along longitude 165°W. and from 40°00'N. to 48°00'N. along longitude 145°W. As in previous catches, these were taken along the Polar Front.

Deep-swimming albacore were sampled exclusively with longline gear. Temperature profiles and the approximate depth of the gear fished suggest that most catches were made in areas of abrupt temperature change, which were probably subsurface manifestations of the Polar Front (figs. 5-8 of the Appendix).

SIZE COMPOSITION

A comparison of size frequencies of surface-caught albacore taken in the central and eastern sectors of the North Pacific shows (fig. 4) that the same size ranges were sampled on either side of the discontinuity in distribution noted above. During the late summer at least three size groups were present in both areas, with modes at 50-55 cm., 60-65 cm., and 75-80 cm. The Smith (cruise 30) captured only 7 albacore; their size range agrees roughly with those taken by the Manning (cruise 26). While the number taken by the Smith is too small for adequate comparison, the size range of 52 albacore (fig. 4) captured at the surface in gill nets west of 160°W. longitude by the Mitkof agrees well with that of the Manning's catch. A similar agreement is indicated in the fall catches, where the same three size groups are represented in the eastern and central sectors of the North Pacific.

The size range of albacore taken in gill nets by the Mitkof corresponds closely to those taken on troll lines by POFI vessels. Such a similarity between gill-netted and troll-caught albacore is also evident in catches made by the John N. Cobb (Powell et al. 1952) off the Oregon

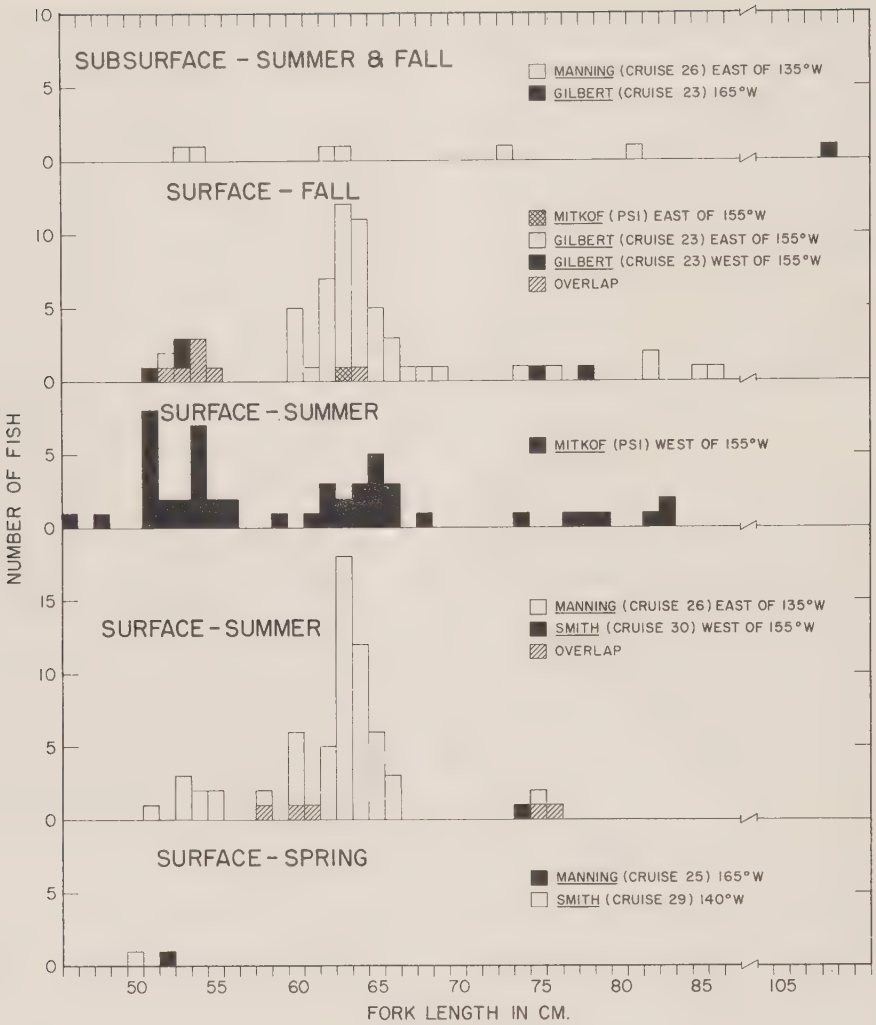
SUBSURFACE - SUMMER & FALL
MANNING (CRUISE 26) EAST OF 135°W
GILBERT (CRUISE 23) 165°W
SURFACE - FALL
MITKOF (PSI) EAST OF 155°W
GILBERT (CRUISE 23) EAST OF 155°W
GILBERT (CRUISE 23) WEST OF 155°W
OVERLAP
SURFACE - SUMMER
MITKOF (PSI) WEST OF 155°W
SURFACE - SUMMER
MANNING (CRUISE 26) EAST OF 135°W
SMITH (CRUISE 30) WEST OF 155°W
OVERLAP
SURFACE - SPRING
MANNING (CRUISE 25) 165°W
SMITH (CRUISE 29) 140°W
NUMBER OF FISH
FORK LENGTH IN CM.

Figure 4.--Comparison of size frequencies of albacore taken in the eastern (open block) and central (filled block) sectors of the North Pacific, showing the degree of overlap (shaded block).

coast during 1950. The size range of 9 fish gill netted by the Gilbert (cruise 23) was 51.3 to 77.5 cm. fork length, which was similar to that of POFI's troll-caught fish (fig. 4).

Although only a few albacore were captured on longline gear, their size range (fig. 4) is of interest. Those taken on longline by the Manning in the eastern North Pacific were essentially the same size as troll-caught fish, while those taken in the central North Pacific were larger. All longline catches made by the Manning were in the same area as the troll catches, and 3 of the 6 fish caught were alive when landed. Two of these were in such good condition when landed, that they were tagged and released. It would appear that of the albacore taken with longline by the Manning, some were deep-swimming fish and others were captured near or at the surface during the retrieving of the gear. A somewhat similar situation was noted in longline catches made by the Paolina T. of the California Department of Fish and Game in the major California albacore grounds, 28°N.-33°N. latitude, 117°W.-122°W. longitude, southeast of the Manning's position (California 1956).

Surface and subsurface albacore caught in the central North Pacific vary in size from north to south. In the summer, surface fish captured between latitudes 45°N. and 48°N. had a size range between 46 cm. and 84 cm., with the bulk of the fish around 64 cm. in length (fig. 4). To the south (38°N.-41°N., 161°W.-180°), and roughly during the same period, August 1955, a Japanese longlining vessel captured 41 large albacore (Nomura 1956). The

smaller surface fish captured to the north by POFI vessels were, for the most part, not represented in the size range of these deep-swimming albacore. Of the 41 fish, 26.8 percent were 81-90 cm. in length, 41.5 percent were 91-100 cm., 17.1 percent were 101-110 cm., and 14.6 percent were 111-120 cm. A similar size contrast was noted between the Gilbert's troll and longline catches during the fall (fig. 4).

During all cruises albacore brought on deck in a viable condition were tagged and returned to the sea (the number tagged, by cruise, is shown in table 19, Appendix); thus there were few data available on the sexual development of the fish. All fish examined were immature, and their gonads had not developed sufficiently for the sexes to be distinguished accurately in the field.

DISTRIBUTIONS OF OTHER FISHES

The seasonal shift in distribution and presumably in abundance noted for the albacore was also apparent in certain other species. Table 3 summarizes the northern seasonal limits at which other fishes were taken within the 140°W. and 150°W. longitudes. This area was chosen as a basis for comparison because it was the one most extensively surveyed during the 1955 cruises (see figs. 1, 2, and 3).

Bigeye tuna, Parathunnus sibi (Temminck and Schlegel), taken on longline gear, showed a progressive shift of their northern limit from approximately 31°N. in the spring to 37°N. in the fall. Although inclement weather during the fall cruise prevented an exact determination, the northward limit of bigeye along 145°W. longitude was somewhere between 37°38'N. and 46°07'N. latitude. An unusual concentration of bigeye was discovered during the spring cruise of the Smith. Fifty-five fish were captured with longline gear between 36°43'N., 143°42'W. and 25°14'N., 148°10'W. In this area a large school of tuna was observed, at a depth of 5 to 10 fathoms, following the boat and apparently feeding on the discarded longline baits. The school was identified by the field party as bigeye tuna. To the west of this catch the Manning (cruise 25) took bigeye in similar latitudes but in smaller numbers.

Skipjack tuna, Katsuwonus pelamis (Linnaeus), taken by both surface trolling and longlining, were not abundant in the catches. The catch data (table 3) showed a seasonal progression northward in their distribution from spring through fall. None was taken within longitudes 140°W. and 150°W. during the summer. To the east of this area they were found at approximately 38°40'N., 132°16'W. and to the west at approximately 43°23'N., 157°24'W. A single large school was observed at about 23°28'N., 159°40'W., during the fall cruise of the Gilbert. The school was composed of large 18- to 25-pound "season" fish.

Only a single yellowfin tuna, Neothunnus macropterus (Temminck and Schlegel), was captured on longline throughout these several cruises and it was taken during the spring. During the summer a large school of yellowfin was sighted on the surface at 35°40'N. latitude, 172°36'W. longitude, by a fisherman on the Smith (cruise 30).

Two fishes, the great blue shark, Prionace glauca (Linnaeus) and the lancet fish, Alepisaurus sp., showed a similar distinct seasonal shift in their distributions. As indicated by the catch rate, their numbers increased progressively northward from spring through fall.

The distribution of dolphin, Coryphaena hippurus (Linnaeus), appeared to shift southward during the fall. The evidence may be erroneous, however, since it was obtained under poor sampling conditions experienced during stormy weather on the northern portion of the eastern leg, along 145°W. longitude, of

Table 3.--Northern seasonal limits of tunas other than albacore and certain other fishes, within 140°W. and 150°W. longitude

Season	Bigeye tuna	Skipjack tuna	Yellowfin tuna	Great blue shark[1/]	Lancet fish[1/]	Dolphin
Spring	30°57'N.	25°52'N.	24°17'N.	39°29'N.	38°32'N.	32°08'N.
Summer	32°13'N.	-	-	41°51'N.	41°51'N.	39°49'N.
Fall	37°36'N.	43°34'N.	-	46°07'N.	46°07'W.	31°06'N.

[1/] Northern limits of largest catch of a single day

the Gilbert's fall cruise (23). On the western leg along 165°W. longitude, under better weather conditions, dolphin were taken as far north as 41°04'N. latitude. Catches were made on both troll and longline gear, often at the same positions.

SUMMARY

1. Five cruises, 4 primarily fishing and 1 primarily oceanographic, were made during the spring, summer, and fall of 1955 to determine the distribution and abundance of albacore tuna to the north and northeast of the Hawaiian Islands.

2. Albacore were scarce in the above areas during the late spring but were relatively abundant during the late summer. The summer distribution was probably discontinuous from east to west, with concentrations in the eastern and central North Pacific sectors and a lack of fish between them. During the fall this intervening area contained albacore in relative abundance, suggesting that the discontinuity was either a transient condition or had diminished somewhat with the change in season.

3. Catches of surface-swimming and possibly those of deep-swimming albacore were associated with the Polar Front, a transition zone between Central Pacific and Subarctic waters. Surface catches were also associated with a seasonal latitudinal change in surface temperature, particularly about the isotherms 55° to 65°F.

4. Comparison of length frequencies of surface-caught albacore taken in the central and eastern sectors of the North Pacific showed that the same size ranges were sampled on either side of the east-west discontinuity noted above. Size ranges of surface-caught and subsurface-caught albacore were similar in the eastern sector, but the latter were, for the most part, larger in the central sector.

5. A latitudinal shift in occurrence, as noted for the albacore, was also displayed by other fishes.

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APPENDIX

Table 4.--List of common and scientific names of fishes with the abbreviations used in Appendix tables 5 through 19

AL	Albacore tuna	Germo alalunga (Bonnaterre)
BC	Barracudina	Anatopterus sp.
BE	Bigeye tuna	Parathunnus sibi (Temminck and Schlegel)
BM	Black marlin	Makaira ampla (Poey)
BR	Bramid	Bramidae
CA	Carangid	Carangidae
DO	Dolphin	Coryphaena hippurus Linnaeus
GS	Great blue shark	Prionace glauca (Linnaeus)
LF	Lancet fish	Alepisaurus sp.
MS	Mackerel shark	Lamna ditropis Hubbs and Follett
BS	Bonito shark	Isurus glaucus Müller and Henle
MF	Moonfish	Lampris regius (Bonnaterre)
SN	Short-nosed spearfish	Tetrapterus angustirostris Tanaka
SJ	Skipjack tuna	Katsuwonus pelamis (Linnaeus)
SS	Soupfin shark	Galeorhinus zyopterus Jordan and Gilbert
SM	Striped marlin	Makaira mitsukurii (Jordan and Snyder)
WM	Silver or white marlin	Istiompax marlina (Jordan and Hill)
WA	Wahoo	Acanthocybium solandri (Cuvier and Valenciennes)
YF	Yellowfin tuna	Neothunnus macropterus (Temminck and Schlegel)

Table 5.--Summary of surface trolling, John R. Manning cruise 25

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Lost, identified	Speed, knots
	N. Lat.	W. Long.	N. Lat.	W. Long.					
5/2	21°15'	158°00'	24°00'	166°20'	3	6	1 YF	-	8
5/3	21°15'	158°00'	24°00'	166°20'	12	24	3 DO	-	8
5/4	21°15'	158°00'	24°00'	166°20'	11.5	23	-	-	9
5/5	24°00'	166°20'	25°50'	174°00'	1.5	3	-	-	6
5/6	24°00'	166°20'	25°50	174°00'	13	26	-	-	8
5/7	24°00'	166°20'	25°50'	174°00'	13	26	-	-	9
5/8	No trolling				-	-	-	-	-
5/9	25°50'	174°00'	28°15'	177°30'	12	24	-	-	8.5
5/10	28°15'	177°30'	28°14'	175°05'	2	4	-	-	8.5
5/11	28°15'	177°30'	28°14'	175°05'	4	20.5	-	-	8
5/12	28°14'	175°05'	28°41'	174°59'	5.5	33	-	-	6
5/13	29°40'	175°12'	30°15'	175°12'	6	36	-	-	6
5/14	31°24'	175°07'	31°57'	175°04'	6	36	-	-	6.5-7
5/15	33°01'	175°00'	33°30'	174°59'	6	36	1 DO	-	6-6.5
5/16	34°29'	175°03'	35°09'	175°02'	6.5	39	-	-	6.5
5/17	36°06'	174°58'	36°47'	175°04'	6.5	39	-	-	6.5
5/18	37°54'	174°46'	38°36'	174°52'	6	36	-	-	6
5/19	39°32'	174°37'	36°50'	171°59'	6	36	-	-	6
5/20	39°32'	174°37'	36°50'	171°59'	14	84	-	-	6.5
5/21	36°50'	171°59'	31°36'	165°16'	13	78	-	-	6
5/22	36°50'	171°59'	31°36'	165°16'	14	84	-	-	6.5
5/23	36°50'	171°59'	31°36'	165°16'	14	84	-	-	6
5/24	31°36'	165°16'	33°40'	165°32'	7	42	-	-	6
5/25	33°40'	165°32'	35°28'	164°54'	6.5	39	4 DO	-	6
5/26	35°28'	164°54'	36°54'	165°13'	5.5	33	1 DO, 1 AL	-	6
5/27	36°54'	165°13'	39°01'	165°10'	6.5	39	-	-	6
5/28	39°01'	165°10'	40°54'	164°54'	6.5	39	-	-	6
5/29	40°54'	164°54'	29°04'	160°01'	6	36	-	-	6
5/30	40°54'	164°54'	29°04'	160°01'	13.5	81	-	-	6
5/31	40°54'	164°54'	29°04'	160°01'	14	84	-	-	6
6/1	40°54'	164°54'	29°04'	160°01'	13.5	81	4 DO	1 DO	6.5
6/2	40°54'	164°54'	29°04'	160°01'	14	84	2 DO	-	6.5
6/3	29°04'	160°01'	27°05'	159°30'	5	30	-	-	7
6/4	27°05'	159°30'	25°23'	159°00'	7	42	4 DO	5 DO	6.5-7
6/5	25°23'	159°00'	23°28'	158°33'	7	42	1 DO	-	6
6/6	23°28'	158°33'	21°15'	158°00'	2	12	-	-	6
Totals					289.5	1,461.5	1 YF 20 DO 1 AL	6 DO	

Table 6.--Catch record, 5-fathom floatline gear, John R. Manning cruise 25

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
28°14'	175°05'	-	-	-	3	-	1 SM, 4 DO
29°40'	175°12'	-	-	-	-	1	1 SM
31°24'	175°07'	-	-	-	6	-	3 DO
33°01'	175°00'	-	-	-	6	-	-
34°29'	175°03'	-	-	-	8	2	-
36°06'	174°58'	-	-	-	14	4	-
37°54'	174°46'	-	-	-	34	-	6 BS, 2 MS
39°32'	174°37'	-	-	-	6	4	-
31°36'	165°16'	-	-	-	2	-	-
33°40'	165°32'	-	-	-	5	1	2 DO
35°28'	164°54'	-	-	-	16	3	-
36°54'	165°13'	-	-	-	22	1	-
39°01'	165°10'	-	-	-	6	2	5 MS
40°54'	164°54'	-	-	-	1	2	3 MS
29°04'	160°01'	-	2	-	1	-	1 SM
27°05'	159°30'	-	-	-	-	-	1 WM, 1 DO
25°23'	159°00'	-	1	-	2	-	1 DO
23°28'	158°33'	-	-	-	-	-	1 BS
Totals		-	3	-	132	20	3 SM 11 DO 7 BS 10 MS 1 WM

Table 7.--Catch record, 15-fathom floatline gear, John R. Manning cruise 25

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
28°14'	175°05'	-	-	-	-	1	-
29°40'	175°12'	-	-	-	1	-	1 DO
31°24'	175°07'	-	-	-	5	3	-
33°01'	175°00'	-	-	-	-	-	-
34°29'	175°03'	-	-	-	4	1	-
36°06'	174°58'	-	-	-	7	3	-
37°54'	174°46'	-	-	-	12	3	-
39°32'	174°37'	-	-	-	3	1	2 MS, 1 BR
31°36'	165°16'	-	-	-	3	-	-
33°40'	165°32'	-	-	-	2	-	2 DO
35°28'	164°54'	-	-	-	7	-	-
36°54'	165°13'	-	-	-	22	2	-
39°01'	165°10'	-	-	-	16	-	4 MS
40°54'	164°54'	-	-	-	1	-	6 MS
29°04'	160°01'	-	2	-	2	-	-
27°05'	159°30'	-	2	-	-	1	1 DO
25°23'	159°00'	-	-	-	1	-	6 DO
23°28'	158°33'	-	-	-	1	1	-
Totals		-	4	-	87	16	10 DO 12 MS 1 BR

Table 8.--Summary of surface trolling, Hugh M. Smith cruise 29

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Speed, knots
	N. Lat.	W. Long.	N. Lat.	W. Long.				
5/3	21°15'	158°00'	28°25'	155°04'	11	22	2 DO	8
5/4	21°15'	158°00'	28°25'	155°04'	12.5	25	-	8
5/5	28°25'	155°04'	28°48'	154°57'	2	12	-	6
5/6	30°03'	155°10'	30°24'	154°56'	4.5	27	-	6
5/7	31°59'	154°46'	32°27'	154°40'	5.5	33	-	6
5/8	33°59'	154°48'	34°22'	154°52'	5	30	-	6
5/9	35°51'	154°52'	36°21'	154°52'	4.5	27	-	6
5/10	37°41'	154°49'	38°20'	154°54'	5	30	-	6
5/11	38°17'	154°43'	38°52'	154°40'	4.5	27	-	6
5/12	40°02'	155°03'	42°26'	154°54'	5	30	-	6
5/13	42°26'	154°54'	40°18'	153°12'	5	30	-	6
5/14	42°26'	154°54'	40°18'	153°12'	12.5	75	-	6
5/15	40°18'	153°12'	34°36'	149°22'	12.5	75	-	6
5/16	40°18'	153°12'	34°36'	149°22'	13.5	81	-	7
5/17	32°08'	147°20'	32°29'	147°16'	4	24	1 DO	6
5/18	33°44'	146°47'	34°29'	146°56'	5	30	-	6
5/19	35°42'	147°29'	36°24'	147°11'	5.5	33	-	6
5/20	37°48'	146°49'	38°31'	146°56'	5	30	-	6
5/21	39°51'	146°42'	40°21'	146°40'	5	30	-	6
5/22	41°50'	147°00'	41°19'	146°28'	3	18	-	6.5
5/23	39°49'	145°19'	36°29'	144°44'	13	78	-	6.5
5/24	36°29'	144°44'	34°03'	142°09'	13	78	-	6
5/25	34°03'	142°09'	37°21'	140°47'	13	78	-	6
5/26	37°21'	140°47'	40°38'	139°06'	13	78	-	6
5/27	40°38'	139°06'	41°39'	139°02'	13.5	81	-	6.5
5/28	40°38'	139°06'	41°39'	139°02'	13	78	-	6
5/29	40°38'	139°06'	41°39'	139°02'	13.5	81	-	6
5/30	41°39'	139°02'	39°29'	139°00'	12	72	-	6
5/31	39°29'	139°00'	38°52'	138°58'	4.5	27	-	6
6/1	37°18'	139°00'	36°40'	138°58'	5	30	-	6
6/2	35°13'	138°47'	33°02'	139°07'	5	30	-	6-6.5
6/3	33°02'	139°07'	30°57'	139°04'	5	30	-	6
6/4	30°57'	139°04'	28°56'	139°07'	5	30	-	6
6/5	28°56'	139°07'	27°55'	141°28'	6.5	39	1 DO, 1 AL	6
6/6	27°55'	141°28'	26°43'	143°42'	5.5	33	1 DO	6
6/7	26°43'	143°42'	25°52'	145°50'	5	30	-	6
6/8	25°52'	145°50'	25°14'	148°10'	4	24	-	6
6/9	25°14'	148°10'	24°17'	150°16'	4	24	1 DO	6
6/10	24°17'	150°16'	23°30'	152°39'	5	30	-	6
6/11	23°30'	152°39'	22°38'	154°46'	5	30	1 DO	6
6/12	22°38'	154°46'	22°02'	156°13'	5	30	-	6
6/13	22°02'	156°13'	21°15'	158°00'	2	12	-	6
6/13	22°02'	156°13'	21°15'	158°00'	2	4	-	8
Totals					303	1,716	7 DO 1 AL	

Table 9.--Catch record, 5-fathom floatline gear, Hugh M. Smith cruise 29

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
28°25'	155°04'	-	1	-	1	-	1 BS
30°03'	155°10'	-	1	-	-	-	1 DO
31°59'	154°46'	-	-	-	1	-	1 BS
33°59'	154°48'	-	-	-	1	-	-
35°51'	154°52'	-	-	-	1	3	1 MF
37°41'	154°49'	-	-	-	11	1	-
38°17'	154°43'	-	-	-	20	5	-
40°02'	155°03'	-	-	-	4	4	1 MS
42°26'	154°54'	-	-	-	-	6	1 MS
32°08'	147°20'	-	-	-	-	1	1 DO
33°44'	146°47'	-	-	-	-	-	-
35°42'	147°29'	-	-	-	-	3	-
37°48'	146°49'	-	-	-	-	-	-
39°51'	146°42'	-	-	-	18	7	-
41°50'	147°00'	-	-	-	3	6	-
41°39'	139°02'	-	-	-	14	5	-
39°29'	139°00'	-	-	-	34	2	-
37°18'	139°00'	-	-	-	1	5	-
35°13'	138°47'	-	-	-	1	2	-
33°02'	139°07'	-	-	-	3	5	-
30°57'	139°04'	-	2	-	-	1	-
28°56'	139°07'	-	-	-	-	1	-
27°55'	141°28'	-	-	-	-	-	1 DO
26°43'	143°42'	-	8	-	-	1	1 DO
25°52'	145°50'	-	3	1 SJ	-	-	1 BS
25°14'	148°10'	-	8	-	-	3	2 DO
24°17'	150°16'	-	-	-	-	-	2 BS, 5 DO, 1 WA
23°30'	152°39'	-	-	-	-	3	1 SN, 1 DO
22°38'	154°46'	-	2	-	1	2	1 DO
22°02'	156°13'	-	-	-	2	-	-
Totals		-	25	1 SJ	116	66	5 BS 13 DO 1 MF 2 MS 1 WA 1 SN

Table 10.--Catch record, 15-fathom floatline gear, Hugh M. Smith, cruise 29

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
28°25'	155°04'	-	3	-	3	1	1 turtle
30°03'	155°10'	-	-	-	-	-	3 DO
31°59'	154°46'	-	-	-	-	1	-
33°59'	154°48'	-	-	-	2	1	-
35°51'	154°52'	-	-	-	-	7	-
37°41'	154°49'	-	-	-	8	5	-
38°17'	154°43'	-	-	-	16	7	1 MS
40°02'	155°03'	-	-	-	5	2	3 MS
42°26'	154°54'	-	-	-	-	2	-
32°08'	147°20'	-	-	-	2	-	2 DO
33°44	146°47'	-	-	-	-	1	-
35°42'	147°29'	-	-	-	2	4	-
37°48'	146°49'	-	-	-	1	5	-
39°51'	146°39'	-	-	-	15	5	-
41°50'	147°00'	-	-	-	3	11	-
41°39'	139°02'	-	-	-	8	12	-
39°29'	139°00'	-	-	-	23	6	-
37°18'	139°00'	-	-	-	4	2	1 MF
35°13'	138°47'	-	-	-	-	6	-
33°02'	139°07'	-	-	-	4	2	1 BS
30°57'	139°04'	-	2	-	-	-	-
28°56'	139°07'	-	-	-	-	3	-
27°55'	141°28'	-	1	-	-	-	3 DO
26°43'	143°42'	-	7	-	-	-	-
25°52'	145°50'	-	21	-	1	1	1 SM, 1 SN
25°14'	148°10'	-	4	-	-	2	-
24°17'	150°16'	-	1	1 YF	1	3	-
23°30'	152°39'	-	2	-	-	1	1 BS
22°38'	154°46'	-	1	-	-	-	1 DO
22°02'	156°13'	-	-	-	2	1	-
Totals		-	42	1 YF	100	91	1 turtle 9 DO 4 MS 1 MF 2 BS 1 SM 1 SN

Table 11.--Summary of surface trolling, Hugh M. Smith cruise 30

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Lost, identified	Lost, unidentified	Speed knots
	N. Lat.	W. Long.	N. Lat.	W. Long.						
7/16	21°15'	158°00'	23°31'	161°06'	9	36	-	-	-	8
7/17	24°01'	162°15'	24°51'	164°01'	3	9	-	-	-	9
7/18	25°20'	165°10'	26°00'	166°40'	9	27	-	-	-	9
7/19	26°21'	168°14'	27°10'	170°29'	9	27	-	-	-	9
7/20	27°13'	171°30'	27°43'	173°50'	9	27	-	-	-	9
7/21	27°57'	175°04'	28°28'	177°45'	11	33	1 WA	-	-	9
7/24	29°02'	178°40'	30°06'	179°54'	10	30	-	-	-	9
7/25	31°12'	179°55'	33°08'	179°57'	10	30	-	-	-	9
7/26	34°10'	179°58'	35°43'	179°51'	10	30	-	-	-	9
7/27	37°15'	179°50'	39°19'	179°51'	10	30	-	-	-	9
7/28	40°19'	179°54'	41°50'	179°54'	10	30	-	-	-	9
7/29	43°19'	179°51'	44°56'	179°49'	9	27	-	-	-	9
7/30	46°06'	179°50'	47°41'	179°39'	11	33	-	-	-	9
7/31	49°29'	179°59'	49°32'	178°22'	8.5	25.5	-	-	-	9
8/1	49°30'	176°32'	49°29'	173°21'	7	21	-	-	-	9
8/2	49°02'	172°32'	47°30'	172°30'	11	33	-	-	-	9
8/3	46°00'	172°34'	45°05'	172°30'	2	6	1 AL	-	-	7-8
8/4	43°30'	172°20'	41°39'	172°16'	11	33	-	-	-	7-8
8/5	40°23'	172°33'	39°02'	172°30'	12	36	-	-	-	9
8/6	37°23'	172°29'	35°26'	172°36'	13	39	-	-	-	9
8/7	34°20'	172°35'	32°13'	172°26'	12	36	4 DO	-	-	9
8/8	30°55'	172°24'	30°09'	171°53'	12	36	-	-	-	8
8/9	29°57'	170°40'	29°53'	168°50'	12	48	-	-	-	8
8/10	29°51'	167°30'	29°55'	165°38'	12	60	-	-	-	8
8/11	30°30'	164°47'	32°36'	164°55'	12	60	-	-	-	8
8/12	33°30'	164°52'	35°36'	164°55'	14	70	-	-	-	8
8/13	37°04'	164°55'	39°00'	164°59'	9	27	-	-	-	8
8/14	40°30'	165°01'	42°03'	164°52'	9	27	-	-	-	8
8/15	43°30'	164°55'	44°57'	165°01'	8	24	-	-	-	8
8/16	46°30'	165°00'	48°04'	164°55'	11	33	-	-	-	4
8/17	49°00'	164°58'	49°35'	163°24'	15	45	-	-	-	7
8/18	49°42'	161°43'	49°36'	158°14'	17	85	-	-	-	9
8/19	48°57'	157°24'	47°30'	157°16'	16	80	4 AL	-	-	7
8/20	46°00'	157°03'	44°57'	157°26'	16	80	2 AL	-	2	7
8/21	43°23'	157°24'	41°30'	157°24'	14	70	1 SJ	4 SJ	-	9
8/22	40°27'	157°31'	38°30'	157°30'	14	70	-	-	-	9
8/23	37°00'	157°30'	35°00'	157°30'	14	70	4 DO	-	-	9
8/24	34°00'	157°33'	32°00'	157°30'	14	70	-	-	-	9
8/25	31°00'	157°30'	29°00'	157°30'	13	65	-	-	-	9
8/26	28°00'	157°35'	26°00'	157°30'	13	65	2 DO	-	-	9
8/27	24°52'	157°33'	23°00'	157°31'	13	65	-	-	-	9
8/28	22°00'	157°35'	21°15'	158°00'	8	40	-	-	-	9
Totals					462.5	1,788.5	1 WA 7 AL 10 DO 1 SJ	4 SJ	2	

Table 12.--Summary of surface trolling, John R. Manning cruise 26

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Lost, identified	Lost, unidentified	Speed, knots
	N. Lat.	W. Long.	N. Lat.	W. Long.						
7/17	21°15'	158°00'	30°51'	151°56'	3	6	-	-	-	7.5
7/17	21°15'	158°00'	30°51'	151°56'	9.5	28.5	-	-	-	7.5
7/18	21°15'	158°00'	30°51'	151°56'	13.5	67.5	4 DO	-	-	7.5
7/19	30°51'	151°56'	32°13'	151°12'	5.5	33	4 DO	-	-	6
7/20	32°13'	151°12'	32°46'	150°51'	4	24	1 DO	-	-	6
7/20	32°13'	151°12'	32°46'	150°51'	1.5	9	-	-	-	8
7/21	33°48'	150°32'	34°23'	150°07'	1.5	9	-	-	-	6
7/21	33°48'	150°32'	34°23'	150°07'	3.5	21	-	-	-	8
7/22	35°29'	149°45'	36°11'	149°00'	2	12	-	-	-	6
7/22	35°29'	149°45'	36°11'	149°00'	4	24	5 DO	-	-	8
7/23	36°59'	148°35'	37°39'	147°55'	7	42	-	-	-	6
7/24	38°32'	147°16'	39°09'	146°45'	7	42	-	-	-	6
7/25	39°49'	146°25'	40°26'	145°52'	7	42	-	-	-	6
7/26	41°03'	145°05'	41°42'	144°49'	7	42	-	-	-	6
7/27	41°51'	144°51'	42°35'	144°02'	6.5	39	-	-	-	6
7/28	43°31'	143°21'	44°06'	142°45'	6.5	39	-	-	-	6
7/29	44°49'	142°10'	44°49'	142°10'	13.5	81	-	-	-	6
7/30	46°22'	141°50'	47°01'	140°30'	14.5	87	-	-	-	6
7/31	47°31'	140°38'	46°59'	139°53'	7	42	-	-	-	6
8/1	46°19'	139°08'	45°49'	138°19'	8	48	-	-	-	6-7
8/2	45°18'	137°34'	44°42'	136°56'	6	36	-	-	-	6
8/3	43°56'	136°10'	42°19'	135°22'	6.5	39	-	-	-	6
8/4	42°29'	134°40'	42°10'	134°23'	6.5	39	1 AL	-	-	6
8/5	41°26'	133°48'	41°03'	133°12'	7	42	2 AL	2 AL	-	6
8/6	40°53'	133°03'	41°36'	132°19'	7	42	1 AL	2 AL	-	6.5
8/7	42°08'	131°30'	42°48'	130°41'	8	48	9 AL	8 AL	-	6.5
8/8	43°25'	130°00'	42°55'	128°58'	7	42	-	-	-	6.5
8/9	42°31'	128°31'	41°39'	126°41'	7.5	45	-	4 AL	-	6.5
8/10	41°39'	126°41'	41°03'	127°26'	6.5	39	-	2 AL	-	6.5
8/11	40°17'	128°18'	39°52'	127°11'	7	42	3 AL	1 AL	-	6.5
8/12	39°52'	127°11'	39°52'	127°11'	12	72	35 AL	18 AL	-	3.5-7
8/20	38°49'	124°57'	38°49'	124°57'	13	78	-	-	-	3.5-7
8/21	36°52'	123°37'	36°24'	123°08'	6	36	-	-	-	6.5
8/22	36°01'	122°59'	35°02'	122°15'	1	6	-	-	-	3.5-7
8/22	36°01'	122°59'	35°02'	122°15'	3	18	3 AL	2 AL	-	6.5
8/23	35°02'	122°15'	35°03'	123°47'	6	36	-	1 AL	-	6.5
8/24	35°03'	123°47'	34°52'	125°14'	13	78	6 AL	3 AL	-	4-7
8/25	34°52'	125°14'	34°58'	126°48'	6.5	39	-	1 AL	-	6.5
8/26	34°58'	126°48'	34°55'	128°33'	6	36	1 AL	1 AL	-	6.5
8/27	34°55'	128°33'	35°00'	129°12'	5	30	-	-	-	6.5
8/28	34°47'	130°17'	35°32'	130°23'	5	30	-	-	-	6.5
8/29	36°20'	131°04'	36°55'	131°15'	5	30	-	1 DO	-	6.5
8/30	37°39'	131°33'	38°03'	131°52'	5.5	33	1 AL	-	-	6.5
8/31	38°43'	132°16'	37°22'	134°09'	5.5	33	2AL,1SJ	-	1	6.5
9/1	37°22'	134°09'	35°44'	135°58'	5	30	-	-	-	6.5
9/2	35°44'	135°58'	34°13'	137°44'	5	30	1 SN	-	-	6-6.5
9/3	34°13'	137°44'	32°26'	139°07'	5	30	-	2 DO	-	6.5
9/4	32°26'	139°07'	30°48'	140°46'	5	30	-	3 DO	-	6.5
9/4	32°26'	139°07'	30°48'	140°46'	0.5	3	-	-	-	9
9/5	30°48'	140°46'	29°41'	143°01'	5	30	-	-	-	6.5
9/5	30°48'	140°46'	29°41'	143°01'	1	6	-	-	-	9
9/6	29°41'	143°01'	21°15'	158°00'	2	12	1 DO	2 DO	-	6.5
9/6	29°41'	143°01'	21°15'	158°00'	4.5	27	-	-	-	9
9/7	29°41'	143°01'	21°15'	158°00'	12.5	75	-	-	-	9-9.5

Table 12.--Summary of surface trolling, John R. Manning cruise 26 (cont'd)

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Lost, identified	Lost, un-identified	Speed, knots
	N. Lat.	W. Long.	N. Lat.	W. Long.						
9/8	29°41'	143°01'	21°15'	158°00'	12.5	75	-	-	-	9-9.5
9/9	29°41'	143°01'	21°15'	158°00'	12.5	75	-	-	-	9-9.5
9/10	29°41'	143°01'	21°15'	158°00'	12	36	3SJ, 1 DO	-	-	9-9.5
Totals					376	2,166	16 DO 64 AL 4 SJ 1 SN	45 AL 8 DO	1	

Table 13.--Catch record, 5-fathom floatline gear, John R. Manning cruise 26

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
30°51'	151°56'	-	3	-	1	1	1 DO
32°13'	151°12'	-	-	-	1	-	3 DO
33°48'	150°32'	-	-	-	-	2	2 DO
35°29'	149°45'	-	-	-	-	-	-
36°59'	148°35'	-	-	-	1	2	1 DO, 1 SN
38°32'	147°16'	-	-	-	2	9	-
39°49'	146°25'	-	-	-	2	5	1 SM, 2 DO
41°03'	145°05'	-	-	-	7	4	-
41°51'	144°26'	-	-	-	54	-	-
43°31'	143°21'	-	-	-	24	1	-
47°31'	140°38'	-	-	-	3	1	1 MS
46°19'	139°08'	-	-	-	15	-	3 BR, 1 MS
45°18'	137°34'	-	-	-	19	2	-
43°56'	136°10'	-	-	-	2	2	-
42°29'	134°40'	-	-	-	4	2	1 MS
41°26'	133°48'	-	-	-	30	-	-
40°53'	133°03'	-	-	-	14	-	-
42°08'	131°30'	-	-	-	14	2	-
43°25'	130°00'	-	-	-	6	2	-
42°31'	128°31'	-	-	-	20	-	-
41°39'	126°41'	-	-	-	36	-	-
40°17'	128°18'	-	-	-	61	-	-
36°52'	123°37'	-	-	-	37	-	2 SS, 1 BC
36°01'	122°59'	-	-	-	15	-	1 MF
35°02'	122°15'	-	-	-	33	-	1 MF, 1 CA
34°52'	125°14'	-	-	-	7	2	-
34°58'	126°48'	1	-	-	7	-	-
34°55'	128°33'	-	-	-	-	4	1 MF
34°47'	130°17'	-	3	-	-	1	1 BS
36°20'	131°04'	-	-	-	2	-	-
37°39'	131°33'	-	-	-	3	-	-
38°43'	132°16'	-	-	-	4	2	-
37°22'	134°09'	-	-	-	-	10	6 DO
35°44'	135°58'	-	1	-	1	1	9 DO
34°13'	137°44'	-	-	-	-	2	1 DO
32°26'	139°07'	-	4	-	-	2	5 DO
30°48'	140°46'	-	1	-	-	1	1 DO
29°41'	143°01'	-	-	-	-	3	1 DO, 1 BM
Totals		1	12	-	425	63	32 DO, 1 SN, 1 SM, 3 MS, 3 BR, 2 SS, 1 BC, 3 MF, 1 BM, 1 CA, 1 BS

Table 14.--Catch record, 15-fathom floatline gear, John R. Manning, cruise 26

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
30°51'	151°56'	-	3	-	-	-	5 DO
32°13'	151°12'	-	1	-	-	2	2 DO
33°48'	150°32'	-	-	-	-	-	1 SM, 1 DO
35°29'	149°45'	-	-	-	2	4	1 SM, 1 DO
36°59'	148°35'	-	-	-	-	-	2 DO, 1 SM
38°32'	147°16'	-	-	-	1	4	-
39°49'	146°25'	-	-	-	-	5	1 SM
41°03'	145°05'	-	-	-	7	2	-
41°51'	144°26'	-	-	-	34	-	1 BS
43°31'	143°21'	-	-	-	20	1	-
47°31'	140°38'	-	-	-	1	3	-
46°19'	139°08'	-	-	-	14	-	2 BR, 1 MS
45°18'	137°34'	-	-	-	12	1	-
43°56'	136°10'	-	-	-	-	1	-
42°29'	134°40'	-	-	-	2	1	-
41°26'	133°48'	-	-	-	25	1	-
40°53'	133°03'	-	-	-	11	-	-
42°08'	131°30'	-	-	-	15	1	-
43°25'	130°00'	-	-	-	2	7	-
42°31'	128°31'	-	-	-	14	-	-
41°39'	126°41'	-	-	-	28	-	-
40°17'	128°18'	1	-	-	39	-	-
36°52'	123°37'	-	-	-	20	-	6 SS
36°01'	122°59'	-	-	-	10	-	-
35°02'	122°15'	-	-	-	23	-	-
34°52'	125°14'	-	-	-	5	1	1 BR
34°58'	126°48'	1	-	-	2	-	1 MS
34°55'	128°33'	1	-	-	1	-	-
34°47'	130°17'	-	-	-	-	-	-
36°20'	131°04'	-	-	-	2	-	-
37°39'	131°33'	2	1	-	2	-	-
38°43'	132°16'	-	-	-	4	2	-
37°22'	134°09'	-	-	-	1	2	5 DO
35°44'	135°58'	-	-	-	-	2	4 DO
34°13'	137°44'	-	-	-	-	3	6 DO
32°26'	139°07'	-	2	-	-	2	3 DO
30°48'	140°46'	-	-	-	-	1	1 BS
29°41'	143°01'	-	2	-	-	5	1 DO, 1 WA
Totals		5	9	-	297	51	30 DO, 4 SM, 2 BS, 3 BR, 2 MS, 6 SS, 1 WA

Table 15.--Summary of surface trolling, Charles H. Gilbert cruise 23

Date 1955	Within positions				Hours trolled	Number of line hours	Catch	Lost, identified	Lost, unidentified	Speed, knots
	N. Lat.	W. Long.	N. Lat.	W. Long.						
9/15	21°15'	158°00'	22°40'	159°10'	2.5	5	-	-	-	9.5
9/16	22°40'	159°10'	24°15'	160°30'	12.5	100	-	-	-	8.5
9/17	25°40'	161°30'	27°05'	162°30'	12.5	100	2 DO	-	-	8.5
9/18	28°35'	163°02'	29°38'	164°32'	11.5	92	1 DO	-	-	8.5
9/19	31°00'	165°05'	32°32'	165°02'	10	80	-	-	-	6.5
9/20	34°00'	165°00'	35°29'	164°50'	12	96	-	-	-	6.5
9/21	36°48'	164°45'	38°14'	164°46'	12.5	100	2 DO	-	-	6.5
9/22	39°38'	164°57'	41°00'	164°57'	13	104	-	-	-	6.5
9/23	40°51'	164°57'	42°21'	164°46'	13	104	-	-	-	6.5
9/24	42°22'	164°41'	43°18'	164°40'	10.5	84	2 AL	3 AL	-	6.5
9/25	43°20'	164°35'	44°28'	164°53'	9.5	76	-	-	4	6.5
9/26	44°40'	164°55'	45°40'	165°05'	9.5	76	1 AL	-	3	6.5
9/27	45°48'	165°00'	46°50'	165°01'	10.5	84	-	-	-	6.5
9/28	47°05'	165°06'	47°39'	166°17'	12.5	59	-	-	-	6-7
9/29	47°21'	166°38'	47°30'	164°52'	9	70	-	-	-	6.5
9/30	47°14'	164°15'	46°50'	164°20'	2.5	20	-	-	-	6.5
9/30	47°14'	164°15'	46°50'	164°20'	2.5	15	-	-	-	8
10/1	45°15'	164°39'	44°44'	164°37'	2	16	-	-	-	6.5
10/1	45°15'	164°39'	44°44'	164°37'	3.5	28	-	-	-	8
10/2	43°09'	164°22'	42°36'	164°24'	5.5	44	-	-	-	6-7
10/3	41°09'	164°31'	40°47'	164°32'	5	40	-	-	1	6.5-7
10/4	39°04'	164°31'	39°22'	164°19'	5	40	2 DO	-	-	6.5-7
10/5	41°18'	162°07'	41°18'	162°07'	12	96	-	-	-	6.5
10/6	41°47'	160°09'	42°18'	158°23'	12	72	-	-	-	6.5
10/8	43°28'	152°37'	43°44'	150°44'	11.5	41	-	1 AL	-	6.5
10/9	43°34'	148°17'	42°12'	147°12'	12	84	14 AL, 2 SJ	2 AL	5	6.5
10/10	41°11'	146°14'	40°32'	144°32'	12	44	2 AL, 1 SJ	1 AL	-	6.5-7.5
10/11	40°02'	143°02'	39°22'	143°46'	12	87.5	1 AL, 1 SJ	-	4	7
10/12	38°05'	144°14'	39°27'	144°12'	11.5	92	-	-	-	6.5-7
10/13	39°41'	144°00'	40°20'	144°15'	12	51	-	-	-	4-6
10/14	40°15'	144°32'	41°25'	144°41'	10	80	6 AL	-	3	6.5
10/15	41°23'	144°38'	42°41'	144°43'	10	80	7 AL	1 AL	-	6.5
10/16	42°40'	144°31'	43°50'	144°52'	10	80	6 AL	2 AL	-	6.5
10/17	43°52'	144°48'	44°56'	144°49'	11.5	82.5	22 AL	2 AL	3	6.5
10/18	44°48'	144°52'	46°14'	144°57'	10.5	84	3 AL	-	2	6.5
10/19	46°36'	144°47'	47°55'	144°37'	11	88	-	-	-	6.5
10/20	47°40'	144°30'	47°30'	144°28'	11.5	61	-	-	-	6.5
10/21	46°07'	144°58'	46°07'	144°58'	2.5	15	-	-	-	3-6.5
10/22	45°32'	144°38'	44°39'	144°44'	10.5	84	-	-	-	6.5
10/23	43°52'	143°58'	42°43'	143°54'	11	88	-	-	1	6.5
10/24	41°07'	143°56'	41°07'	143°56'	1	8	-	-	-	5-6.5
10/25	39°48'	144°23'	38°42'	144°12'	10	80	-	-	-	6.5
10/26	37°21'	144°42'	37°16'	144°50'	4	32	-	-	-	6.5
10/27	35°45'	145°22'	35°17'	145°34'	4	32	-	-	-	6.5
10/28	34°05'	145°50'	32°50'	146°06'	12	96	1 DO, 1 SJ	-	-	6.5-7
10/29	31°06'	146°40'	29°53'	147°10'	12	84	-	-	-	6.5
10/30	28°45'	149°00'	27°20'	150°35'	12	84	1 SJ	1 SJ	1	9
10/31	26°10'	152°05'	25°00'	153°20'	12	96	-	-	-	9
11/1	23°50'	154°45'	22°30'	156°10'	12.5	75	-	-	-	9
11/2	21°20'	157°40'	21°15'	158°00'	3	18	-	-	-	9
Totals					463	3,348	8 DO 64 AL 6 SJ	12 AL 1 SJ	27	

Table 16.--Catch record, 5-fathom floatline gear, Charles H. Gilbert cruise 23

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
47°14'	164°15'	-	-	-	1	2	-
45°08'	164°40'	-	-	-	6	1	-
43°12'	164°30'	-	-	-	5	1	-
41°04'	164°29'	1	-	-	3	-	1 DO
39°04'	164°40'	-	-	-	5	1	3 DO
46°07'	144°58'	-	-	-	12	-	-
37°36'	144°40'	-	1	-	1	-	-
35°49'	145°20'	-	2	1 SJ	-	-	-
Totals		1	3	1 SJ	33	5	4 DO

Table 17.--Catch record, 15-fathom floatline gear, Charles H. Gilbert cruise 23

Position		Tuna			GS	LF	Miscellaneous
N. Lat.	W. Long.	AL	BE	Others			
47°14'	164°15'	-	-	-	-	4	-
45°08'	164°40'	-	-	-	4	2	1 BS
43°12'	164°30'	-	-	-	5	1	-
41°04'	164°29'	-	-	-	4	1	1 DO
39°04'	164°40'	-	-	-	3	2	3 DO
46°07'	144°58'	-	-	-	4	1	-
37°36'	144°40'	-	-	-	2	1	-
35°49'	145°20'	-	2	-	-	1	-
Totals		-	2	-	22	13	1 BS 4 DO

Table 18.--Gill-net catch record, Charles H. Gilbert cruise 23

Position		Date set	AL	GS	Others
N. Lat.	W. Long.	1955			
43°22'	164°40'	9/24	8	2	-
44°38	164°55'	9/25	1	9	-
45°41'	165°05'	9/26	1	9	Squid (fragments)
47°30'	164°52'	9/29	-	3	1 BR, 1 fur seal
41°25'	144°42'	10/14	1	-	1 BR
Totals			11	23	2 BR 1 fur seal Squid (fragments)

Table 19.--Number of fish tagged[1/] during the 1955 albacore cruises

Cruises	Number tagged	
	AL	Others
Manning 25	-	2 BE
Manning 26	63	9 BE
Smith 29	1	17 BE
		1 YF
Smith 30	-	-
Gilbert 23	52	-
Total	116	29 BE
		1 YF

[1/] The "type G" tag (Wilson 1953) and tagging methods employed were similar to those used by POFI on previous albacore cruises (Shomura and Otsu 1956).

Table 20.--Secchi disc measurements, Hugh M. Smith cruise 29

Position		Date	Meters[1/]
N. Lat.	W. Long.	1955	
28°25'	155°04'	5/5	47.5
30°03'	155°10'	5/6	32.9
31°59'	154°46'	5/7	23.8
33°59'	154°48'	5/8	21.9
35°51'	154°52'	5/9	25.6
37°41'	154°49'	5/10	21.9
38°17'	154°43'	5/11	11.0[2/]
40°02'	155°03'	5/12	12.8[2/]
42°26'	154°54'	5/13	20.1
32°08'	147°20'	5/17	20.1
33°44'	164°47'	5/18	23.8
35°42'	147°29'	5/19	21.9
37°48'	146°49'	5/20	21.9
29°51'	146°42'	5/21	14.6[2/]
41°50'	147°00'	5/22	14.6[2/]
41°39'	139°02'	5/30	9.1[2/]
39°29'	139°00'	5/31	16.5[2/]
37°18'	139°00'	6/1	21.9
35°13'	138°47'	6/2	27.4
33°02'	139°07	6/3	20.1
30°57'	139°04'	6/4	25.6
28°56'	139°07'	6/5	21.9
27°55'	141°28'	6/6	27.4
26°43'	143°42'	6/7	29.3
25°52'	145°50'	6/8	29.3
25°14'	148°10'	6/9	25.6
24°17'	150°16'	6/10	25.6
23°30'	152°39'	6/11	20.1
22°38'	154°46'	6/12	20.1
22°02'	156°13'	6/13	20.1

[1/] Original measurements made in fathoms
[2/] Relatively low transparency

Table 21.--Secchi disc measurements, John R. Manning cruise 25

Position		Date	Meters
N. Lat.	W. Long.	1955	
28°14'	175°05'	5/12	38
29°40'	175°12'	5/13	24
31°24'	175°07'	5/14	23
33°01'	175°00'	5/15	23
34°29'	175°03'	5/16	27
36°06'	174°58'	5/17	12[1/]
37°54'	174°46'	5/18	20
39°32'	174°37'	5/19	24
31°36'	165°16'	5/24	30
33°40'	165°32'	5/25	27
35°28'	164°54'	5/26	19[1/]
36°54'	165°13'	5/27	18[1/]
39°01'	165°10'	5/28	15[1/]
40°54'	164°54'	5/29	21
29°04'	160°01'	6/3	37
27°05'	159°30'	6/4	33
25°23'	159°00'	6/5	34
23°28'	158°33'	6/6	33

[1/] Relatively low transparency

Table 22.--Secchi disc measurements, John R. Manning cruise 26[1/]

Position		Date	Meters[2/]
N. Lat.	W. Long.	1955	
30°51'	151°56'	7/19	36.6
32°13'	151°12'	7/20	29.3
33°48'	150°32'	7/21	22.8
35°29'	149°45'	7/22	27.4
36°59'	148°35'	7/23	32.0
38°32'	147°16'	7/24	25.6
39°49'	146°25'	7/25	26.5
41°03'	145°05'	7/26	15.5[3/]
41°51'	144°26'	7/27	15.5[3/]
43°31'	143°21'	7/28	20.1
47°31'	140°38'	7/31	12.8[3/]
46°19'	139°08	8/1	13.7[3/]
45°18'	137°34'	8/2	18.3
43°56'	136°10'	8/3	14.6[3/]
42°29'	134°40'	8/4	19.2
41°26	133°48'	8/5	21.9
40°53'	133°03'	8/6	21.9
42°08'	131°30'	8/7	22.8
43°25'	130°00'	8/8	23.8
42°31'	128°31'	8/9	16.5[3/]
41°39'	126°41'	8/10	13.7[3/]
40°17'	128°18'	8/11	14.6[3/]
36°52'	123°37'	8/21	14.6[3/]
36°01'	122°59'	8/22	13.7[3/]
35°02'	122°15'	8/23	11.0[3/]
34°52'	125°14'	8/25	12.8[3/]
34°55'	128°33'	8/27	20.1
34°47'	130°17'	8/28	27.4
36°20'	131°04'	8/29	32.9
37°39'	131°33'	8/30	21.9
38°43'	132°16'	8/31	27.4
37°22'	134°09'	9/1	32.9
35°44'	135°58'	9/2	29.3
34°13'	137°44'	9/3	31.1
32°26'	139°07'	9/4	32.9
30°48'	140°46'	9/5	31.1
29°41'	143°01'	9/6	23.8

[1/] Secchi disc readings taken during cruise 30 of the Smith have been published previously (McGary et al. 1956).

[2/] Original measurements were made in fathoms.

[3/] Relatively low transparency

Table 23.--Secchi disc measurements, Charles H. Gilbert cruise 23

Position		Date	Meters
N. Lat.	W. Long.	1955	
43°54'	164°38'	9/25	22
44°58'	164°57'	9/26	10 1/
45°52'	165°00'	9/27	9 1/
47°23'	166°14'	9/29	10 1/
47°14'	164°15'	9/30	10 1/
45°08'	164°40'	10/1	12 1/
43°12'	164°30'	10/2	15 1/
41°04'	164°29'	10/3	15 1/
39°04'	164°40'	10/4	27
38°37'	144°19'	10/12	27
40°46'	144°36'	10/14	26
43°14'	144°36'	10/16	14 1/
45°29'	144°54'	10/18	14 1/
37°36'	144°40'	10/26	21

1/ Relatively low transparency

Table 24.--Salinity and relevant data, John R. Manning cruise 25

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
24	28°14'	175°05'	5/12	2335	35.71	76.0	75.0
26	28°59'	176°00'	5/13	0930	35.51	73.2	72.0
28	29°40'	175°12'	5/13	2329	35.19	70.5	70.1
30	30°24'	175°12'	5/14	0930	34.86	67.7	68.3
32	31°24'	175°08'	5/14	2355	35.03	68.6	68.8
34	32°04'	175°04'	5/15	0940	34.81	65.5	65.2
36	33°01'	175°00'	5/15	2330	34.76	65.5	67.9
38	33°41'	175°00'	5/16	0937	34.63	63.6	63.9
40	34°29'	175°04'	5/16	2340	34.65	62.0	58.0
42	35°17'	175°03'	5/17	0930	34.63	60.1	55.0
44	36°06'	174°58'	5/17	2335	34.62	59.3	58.0
46	36°53'	174°56'	5/18	0932	34.55	58.2	56.5
48	37°54'	174°46'	5/18	2340	34.58	56.0	57.5
50	38°42'	174°52'	5/19	0940	34.43	55.0	57.2
52	39°32'	174°37'	5/19	2325	34.53	55.4	58.5
54	39°08'	174°22'	5/20	0700	34.43	55.5	58.3
56	38°06'	173°17'	5/20	1600	34.36	56.0	54.8
58	37°12'	172°21'	5/21	0200	34.59	60.5	59.8
60	36°16'	171°28'	5/21	2100	34.53	59.6	62.0
62	35°09'	170°34	5/22	0700	34.87	62.4	65.0
64	34°06'	169°34'	5/22	1600	34.61	63.6	64.7
66	33°14'	168°43'	5/23	0200	34.61	66.0	65.7
68	32°17'	167°50'	5/23	1130	34.67	69.4	70.2
70	31°31'	166°52	5/23	2100	34.97	69.5	71.5
72	31°31'	165°38'	5/24	0700	34.99	70.7	72.0
74	31°36'	165°16'	5/24	2225	35.03	71.0	74.3
76	32°34'	165°18'	5/25	0830	34.90	69.0	70.9
78	33°40'	165°32'	5/25	2220	34.99	68.5	71.4
80	34°19'	165°20'	5/26	0830	34.55	66.8	68.4
82	35°28'	164°54'	5/26	2225	34.55	64.2	67.2
84	36°09'	165°05'	5/27	0830	34.50	61.0	59.0
86	36°54'	165°13'	5/27	2215	34.71	57.0	53.3
88	37°55'	165°04'	5/28	0835	34.57	57.3	54.0
90	39°01'	165°10'	5/28	2213	34.38	56.4	55.0
92	39°51'	165°10'	5/29	0828	34.24	54.3	59.5
94	46°54'	164°54'	5/29	2215	34.10	51.8	60.5
96	40°43'	164°34'	5/30	0700	34.07	54.0	57.0
97	39°41'	164°10'	5/30	1135	33.81	56.6	60.0
99	38°43'	163°27'	5/30	2100	34.10	57.5	61.3
101	37°49'	162°48'	5/31	0700	34.15	58.1	61.5
103	36°47'	162°04'	5/31	1600	34.23	60.8	62.5
105	35°55'	161°22'	6/1	0200	34.30	62.0	66.7
107	34°18'	160°43'	6/1	1130	34.38	65.4	67.3
109	33°43'	160°06'	6/1	2100	34.79	68.0	70.0
111	32°44'	159°33'	6/2	0700	35.36	70.0	70.5
113	31°30'	159°42'	6/2	1600	34.91	70.1	70.5
115	30°29'	159°56'	6/3	0200	35.15	73.0	71.5
118	29°04'	160°01'	6/3	2215	35.51	73.6	73.9
120	28°03'	159°51'	6/4	0830	35.49	73.2	72.0
122	27°05'	159°30'	6/4	2205	35.70	74.4	75.2
124	27°09'	159°18'	6/5	0830	35.71	74.1	72.8
126	25°23'	159°00'	6/5	2215	35.47	74.5	75.6
128	24°15'	158°46'	6/6	0830	35.13	73.5	73.0
130	23°28'	158°33'	6/6	2220	35.37	74.5	77.0

Table 25.--Salinity and relevant data, Hugh M. Smith cruise 29

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
5	26°33'	155°26'	5/5	0200	35.24	72.1	70.0
7	27°58'	155°09'	5/5	1130	35.35	70.1	69.5
8	28°25'	154°57'	5/5	1740	35.37	70.2	69.6
11	28°46'	154°57'	5/6	0700	35.71	70.0	70.6
12	29°21'	154°55'	5/6	1130	35.44	69.0	69.0
13	30°00'	155°00'	5/6	1725	35.17	67.8	69.0
16	30°37'	154°58'	5/7	0715	35.27	69.6	69.0
17	31°16'	154°56'	5/7	1130	35.17	67.2	69.2
18	31°54'	154°49'	5/7	1715	35.05	66.5	68.2
21	32°30'	154°39'	5/8	0655	34.67	65.4	69.0
22	33°13'	154°45'	5/8	1130	34.63	65.8	68.0
23	33°54'	154°45'	5/8	1710	34.77	65.0	67.8
26	34°25'	154°50'	5/9	0650	34.34	63.2	67.3
27	35°06'	154°53'	5/9	1130	34.27	62.6	65.0
28	35°52'	154°53'	5/9	1700	33.99	60.3	62.9
31	36°21'	154°51'	5/10	0650	34.06	60.5	59.0
32	36°48'	154°46'	5/10	1115	34.13	59.0	56.8
33	37°40'	154°53'	5/10	1705	34.12	58.0	55.0
36	38°20'	154°56'	5/11	0700	34.12	56.0	55.7
37	38°23'	154°51'	5/11	1125	33.96	55.7	55.7
41	38°52'	154°40'	5/12	0730	33.93	56.2	57.8
42	39°24'	154°50'	5/12	1130	33.93	56.0	57.2
43	40°08'	155°02'	5/12	1715	33.74	53.1	58.0
46	40°40'	155°02'	5/13	0700	33.74	52.0	54.9
47	41°20'	154°57'	5/13	1130	33.71	51.0	53.0
48	42°20'	154°57'	5/13	1700	33.57	50.0	51.9
51	41°42'	154°16'	5/14	0700	33.68	52.5	54.8
53	40°40'	153°28'	5/14	1600	33.70	53.3	54.7
56	39°30'	152°36'	5/15	0200	33.75	57.8	58.8
58	38°76'	152°06'	5/15	1135	33.86	57.3	59.3
60	37°12'	151°06'	5/15	2110	34.07	59.3	63.0
62	36°06'	150°19'	5/16	0700	34.04	61.6	64.0
64	34°51'	149°25'	5/16	1600	34.16	63.9	65.3
66	33°42'	148°38'	5/17	0200	34.33	65.8	69.0
68	32°38'	147°54'	5/17	1130	34.50	66.1	68.0
69	32°12'	147°17'	5/17	1700	34.84	66.3	69.9
72	32°30'	147°17'	5/18	0700	34.57	66.4	69.2
73	33°08'	147°07'	5/18	1130	34.56	65.6	66.2
74	33°41'	141°48'	5/18	1700	34.10	63.6	61.9
77	34°25'	146°50'	5/19	0655	34.16	62.7	62.1
78	35°04'	147°09'	5/19	1130	34.16	63.0	61.5
79	35°36'	147°31'	5/19	1650	34.10	61.7	62.0
82	36°29'	147°12'	5/20	0700	34.03	61.0	62.0
83	37°04'	147°03'	5/20	1130	33.93	60.2	62.8
84	37°53'	147°00'	5/20	1700	33.93	60.0	63.0
87	38°33'	146°52'	5/21	0655	33.86	59.2	62.0
88	39°10'	146°43'	5/21	1130	33.75	57.0	56.5
89	39°53'	146°40'	5/21	1655	33.74	56.9	60.0
92	40°23'	146°39'	5/22	0700	33.75	56.5	61.0
93	41°03'	146°49'	5/22	1130	33.50	54.9	58.0

Table 25.--Salinity and relevant data, Hugh M. Smith cruise 29 (cont'd)

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
94	41°51'	147°00'	5/22	1650	33.45	53.8	57.9
97	41°14'	146°26'	5/23	0705	33.49	54.5	57.0
98	40°50'	146°03'	5/23	1130	33.73	56.8	57.5
100	39°32'	145°12'	5/23	2100	33.88	59.8	62.0
102	38°12'	144°59'	5/24	0700	33.95	61.5	63.5
104	36°42'	144°45'	5/24	1600	34.04	62.5	63.5
106	35°44'	144°18'	5/24	2215	33.99	64.0	67.0
108	35°06'	143°54'	5/25	0200	34.02	64.5	65.0
110	33°50'	142°54'	5/25	1130	34.43	63.8	63.5
112	34°29'	141°56'	5/25	2100	34.43	64.0	66.0
114	35°58'	141°15'	5/26	0700	33.97	62.7	63.5
116	37°06'	140°54'	5/26	1600	33.95	61.0	61.5
118	38°31'	140°12'	5/27	0200	33.39	60.0	63.0
120	39°54'	139°24'	5/27	1130	33.42	58.5	61.0
122	40°55'	139°07'	5/27	2100	33.35	56.8	61.0
124	42°19'	139°07'	5/28	0700	33.08	54.3	58.5
126	43°54'	139°02'	5/28	1600	32.95	51.5	54.5
128	45°20'	138°55'	5/29	1130	32.90	49.5	49.0
129	44°09'	138°55'	5/29	2100	32.94	50.5	51.0
131	42°47'	139°01'	5/30	0700	33.11	53.5	53.0
132	42°18'	139°01'	5/30	1130	33.12	54.0	52.0
133	41°48'	138°57'	5/30	1645	33.30	54.0	52.6
136	41°06'	139°05'	5/31	0700	33.31	55.2	53.9
137	40°24'	139°02'	5/31	1130	33.49	56.5	54.5
138	39°24'	139°02'	5/31	1650	33.43	56.8	57.0
141	38°51'	138°58'	6/1	0700	33.48	57.2	57.0
142	38°10'	138°58'	6/1	1130	33.44	58.6	55.9
143	37°18'	139°05'	6/1	1615	33.67	59.8	56.5
146	36°40'	138°56'	6/2	0655	33.73	59.1	59.9
147	36°00'	138°56'	6/2	1130	33.69	60.3	57.5
148	35°11'	138°54'	6/2	1645	34.04	61.1	60.2
151	34°27'	138°50'	6/3	0700	34.11	61.0	60.0
158	33°41'	138°54'	6/3	1130	34.16	61.5	59.0
159	33°01'	139°06'	6/3	1640	34.20	61.9	60.1
162	32°20'	139°03'	6/4	0700	34.24	61.4	61.0
164	30°58'	139°08'	6/4	1640	34.70	62.9	60.9
167	30°19'	138°57'	6/5	0700	35.01	64.4	63.5
168	29°39'	138°58'	6/5	1130	34.99	64.4	63.8
169	28°55'	139°12'	6/5	1645	34.96	64.8	65.0
173	28°28'	140°49'	6/6	1130	35.27	66.7	64.0
174	28°03'	141°25'	6/6	1640	35.25	66.5	63.5
177	27°37'	142°23'	6/7	0700	35.20	68.9	66.5
178	27°21'	143°05'	6/7	1130	35.27	68.1	67.1
179	26°53'	143°48'	6/7	1640	35.32	68.9	68.5
182	26°39'	144°16'	6/8	0700	35.08	69.8	69.5
183	26°17'	145°13'	6/8	1130	35.38	68.8	68.5
184	25°54'	145°48'	6/8	1645	35.37	69.8	69.0
187	25°38'	146°34'	6/9	0700	35.41	70.0	70.8
188	25°35'	147°20'	6/9	1130	35.31	70.0	70.9
189	25°12'	148°11'	6/9	1640	35.06	71.2	72.0

Table 25.--Salinity and relevant data, Hugh M. Smith cruise 29 (cont'd)

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
192	24°57'	148°49'	6/10	0705	35.07	71.1	71.1
193	24°40'	149°33'	6/10	1130	34.83	72.3	70.5
194	24°20'	150°17'	6/10	1640	35.03	71.5	71.0
197	24°01'	151°00'	6/11	0700	34.81	72.7	71.5
198	23°43'	151°47'	6/11	1130	35.00	72.6	72.7
199	23°28'	152°34'	6/11	1645	35.14	72.1	72.0
202	23°10'	153°12'	6/12	0700	34.83	72.9	71.9
203	22°52'	153°54'	6/12	1130	34.78	73.0	72.1
204	22°37'	154°47'	6/12	1640	34.59	73.2	70.0
207	22°25'	155°17'	6/13	0700	34.89	74.7	73.2
208	22°13'	155°41'	6/13	1130	34.88	74.1	74.0
209	22°07'	156°13'	6/13	1635	34.77	73.5	73.8

Table 26.--Salinity and relevant data, John R. Manning cruise 26[1/]

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
2	23°10'	156°39'	7/16	2100	35.21	74.9	75.0
4	24°16'	155°56'	7/17	0600	35.78	74.2	74.8
6	25°12'	155°24'	7/18	1600	35.34	73.0	72.8
8	26°13'	154°49'	7/18	0130	35.51	74.6	74.6
10	27°14'	154°11'	7/18	1140	36.08	73.5	69.8
12	28°37'	153°17'	7/18	2100	35.78	74.0	72.8
14	29°38'	152°37'	7/19	0530	35.65	72.8	71.5
17	30°51'	151°56'	7/19	2230	35.61	75.2	72.5
19	31°14'	151°31'	7/20	0530	35.74	73.5	72.8
22	32°13'	151°12'	7/20	2225	35.30	73.5	72.8
24	32°38'	150°45'	7/21	0530	35.43	71.5	69.9
27	33°48'	150°32'	7/21	2230	35.37	72.5	71.2
29	34°16'	150°10'	7/22	0530	34.92	71.6	70.1
32	35°29'	149°46'	7/22	2100	34.72	71.2	70.0
35	36°34'	148°42'	7/23	1130	34.45	69.9	68.1
37	36°59'	148°36'	7/23	2125	34.69	69.8	70.5
40	38°08'	147°30'	7/24	1130	34.36	68.3	64.8
42	38°22'	147°16'	7/24	2120	34.32	69.0	66.0
45	39°38'	146°30'	7/25	1130	33.91	65.6	63.6
47	39°49'	146°25'	7/25	2105	34.04	65.8	67.5
50	40°55'	145°23'	7/26	1130	33.85	63.9	63.0
52	41°03'	145°05'	7/26	2105	33.62	63.5	67.0
55	41°54'	144°31'	7/27	1130	33.22	60.5	59.8
57	41°59'	144°26'	7/27	2120	33.31	60.3	60.2
60	43°02'	144°00'	7/28	1130	33.18	59.4	59.0
62	43°31'	143°21'	7/28	2115	33.10	59.0	60.5
65	44°33'	142°26'	7/29	1130	32.97	57.1	59.7
67	44°48'	142°12'	7/29	2115	33.03	57.4	57.6
69	46°01'	141°25'	7/30	1130	32.72	55.0	56.2
71	46°22'	141°50'	7/30	2100	32.81	55.0	55.0

[1/] Equivalent data from cruise 30 of the Hugh M. Smith have been published previously (McGary et al. 1956).

Table 26.--Salinity and relevant data, John R. Manning cruise 26[1/] (cont'd)

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
73	47°24'	140°33'	7/31	1130	32.83	54.6	54.8
75	47°31'	140°38'	7/31	2115	32.88	54.1	55.9
78	46°39'	139°23'	8/1	1130	32.76	55.0	55.5
80	46°19'	139°08'	8/1	2105	32.94	56.5	56.4
83	45°31'	137°50'	8/2	1130	32.84	56.5	57.0
85	45°18'	137°34'	8/2	2125	32.87	56.6	57.2
88	44°14'	136°32'	8/3	1130	32.91	58.2	56.5
90	43°56'	136°10'	8/3	2110	32.96	57.9	57.4
93	42°53'	135°04'	8/4	1130	33.00	58.0	57.2
95	42°29'	134°40'	8/4	2130	33.13	59.8	57.5
98	41°44'	134°05'	8/5	1130	33.27	60.0	58.5
100	41°26'	133°48'	8/5	2015	33.22	60.1	58.5
104	40°53'	133°03'	8/6	2020	33.26	61.0	59.5
108	42°08'	131°30'	8/7	2015	33.00	60.2	62.1
111	43°18'	130°11'	8/8	1130	32.94	58.5	59.2
113	43°25'	130°00'	8/8	2015	32.86	58.8	59.3
117	42°32'	128°31'	8/9	2015	32.75	59.8	61.2
121	41°40'	126°41'	8/10	2020	32.18	59.6	61.0
124	40°37'	127°56'	8/11	1130	32.74	59.5	60.0
126	40°17'	128°18'	8/11	2015	32.52	59.7	61.5
130	39°50'	127°08'	8/12	2045	32.83	60.0	60.0
133	38°49'	124°57'	8/20	2000	33.39	53.8	59.2
136	37°06'	123°39'	8/21	1130	33.64	55.1	56.5
138	36°52'	123°38'	8/21	2000	33.68	55.9	58.2
142	36°02'	122°59'	8/22	2030	33.60	56.7	58.5
146	35°02'	122°15'	8/23	2000	33.86	57.5	57.9
148	35°01'	123°06'	8/24	0530	33.78	55.9	57.9
150	35°04'	123°51'	8/24	1800	33.40	57.5	58.9
152	35°01'	124°59'	8/25	0530	33.39	57.5	58.0
154	34°52'	125°14'	8/25	2032	33.15	58.3	59.0
156	34°56'	126°10'	8/26	0530	33.62	60.5	59.9
158	34°58'	126°48'	8/26	2010	33.46	60.3	61.1
160	35°06'	127°48'	8/27	0530	33.46	61.7	62.2
162	34°55'	128°33'	8/27	2115	33.30	63.2	63.5
164	35°00'	129°12'	8/28	0530	33.49	64.2	65.2
166	34°48'	130°17'	8/28	2100	33.50	66.1	65.3
168	35°32'	130°23'	8/29	0530	33.03	64.0	63.8
171	36°20'	131°04'	8/29	2110	33.43	65.3	65.7
173	36°55'	131°15'	8/30	0530	33.46	65.1	64.9
175	37°39'	131°33'	8/30	2110	33.36	66.1	68.2
177	38°03'	131°52'	8/31	0535	33.26	66.2	67.5
179	38°43'	132°16'	8/31	2115	33.36	67.0	69.4
181	38°05'	133°02'	9/1	0630	33.37	66.7	67.8
184	37°22'	134°09'	9/1	2055	33.30	68.0	74.6
186	36°38'	134°52'	9/2	0530	33.98	70.2	70.2
189	35°44'	135°58'	9/2	2110	34.09	70.9	74.1
191	35°10'	136°24'	9/3	0530	34.23	70.6	72.3
194	34°14'	137°44'	9/3	2115	34.28	71.5	70.5
196	33°40'	138°04'	9/4	0530	34.20	71.0	69.2

[1/] Equivalent data from cruise 30 of the Hugh M. Smith have been published previously (McGary et al. 1956).

Table 26.--Salinity and relevant data, John R. Manning cruise 26[1/] (cont'd)

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
199	32°26'	139°08'	9/4	2100	34.72	70.8	71.2
201	31°54'	139°34'	9/5	0530	34.98	70.5	70.0
204	30°48'	140°46'	9/5	2115	34.99	73.2	73.8
206	30°26'	141°31'	9/6	0530	35.03	72.9	73.1
209	29°42'	143°02'	9/6	2045	35.27	74.5	74.9
211	29°12'	143°52'	9/7	0600	35.83	74.2	73.1
213	28°25'	145°23'	9/7	1600	35.66	72.8	72.6
215	27°44'	146°52'	9/8	0130	35.61	74.8	75.2
217	26°53'	148°16'	9/8	1130	35.74	73.8	72.5
219	26°04'	149°36'	9/8	2100	35.40	75.8	75.2
221	25°16'	150°52'	9/9	0600	35.42	74.9	73.8
223	24°29'	152°19'	9/9	1600	35.37	74.0	72.9
225	23°43'	153°40'	9/10	0130	35.21	78.0	75.7
227	22°52'	155°03'	9/10	1130	35.12	75.9	74.5

[1/] Equivalent data from cruise 30 of the Hugh M. Smith have been published previously (McGary et al. 1956).

Table 27.--Salinity and relevant data, Charles H. Gilbert cruise 23

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
1	22°45'	159°10'	9/16	0630	34.97	77.0	75.2
3	24°14'	160°17'	9/17	0530	34.96	77.5	78.0
5	25°41'	161°25'	9/17	1730	35.35	77.2	76.2
7	27°07'	162°28'	9/18	0530	35.29	77.5	78.1
9	28°35'	163°35'	9/18	1730	35.41	77.9	77.4
11	29°38'	164°32'	9/19	0530	35.61	78.0	77.2
13	31°07'	165°05'	9/19	1730	35.21	76.3	74.0
15	32°32'	165°02'	9/20	0530	35.05	75.5	74.9
17	34°09'	165°00'	9/20	1730	34.89	74.9	71.0
19	35°29'	164°50'	9/21	0530	34.67	74.2	74.0
21	36°54'	164°41'	9/21	1730	34.31	72.0	72.8
23	38°14'	164°46'	9/22	0530	34.09	71.0	72.0
25	39°44'	164°57'	9/22	1730	34.34	70.0	70.0
27	41°05'	164°57'	9/23	0530	33.96	65.9	60.2
29	42°21'	164°46'	9/24	0530	33.37	60.5	56.5
33	44°07'	164°43'	9/25	2330	33.26	60.9	59.0
35	45°12'	164°59'	9/26	2330	33.19	58.2	63.0
37	46°10'	165°00'	9/27	2330	32.81	55.2	50.7
39	47°23'	166°14'	9/29	2045	32.66	53.5	52.0
44	47°14'	164°25'	10/1	0130	32.75	53.9	53.9

Table 27.--Salinity and relevant data, Charles H. Gilbert cruise 23 (cont'd)

BT No.	Position		GCT date 1955	GCT time	Surface salinity ‰	Surface temp. °F.	Air temp. °F.
	N. Lat.	W. Long.					
47	45°10'	164°43'	10/1	1740	33.22	57.0	55.0
51	43°55'	164°27'	10/2	1130	33.68	59.5	58.2
52	43°15'	164°32'	10/2	1745	33.61	60.4	58.4
55	42°34'	164°24'	10/3	0530	33.60	61.0	61.2
57	41°05'	164°28'	10/3	1750	34.03	65.2	66.2
60	40°32'	164°34'	10/4	0530	34.20	67.1	66.7
63	39°04'	164°40'	10/4	2210	34.32	69.0	69.9
65	39°31'	164°14'	10/5	0530	32.72	67.5	68.0
67	40°41'	163°24'	10/5	1940	34.31	66.0	62.8
68	41°49'	160°00'	10/6	1730	34.00	68.0	58.0
70	42°20'	158°17'	10/7	0530	33.77	61.2	58.0
-	42°20'	158°18'	10/7	2330	33.49	58.8	59.3
-	43°36'	155°20'	10/8	1730	33.58	57.8	58.8
-	43°27'	152°22'	10/9	0520	33.12	56.5	52.8
71	43°24'	148°10'	10/9	1730	33.66	58.0	53.1
73	42°04'	147°06'	10/10	0530	33.26	60.2	57.0
-	41°09'	146°06'	10/10	1730	33.60	66.0	66.0
-	40°27'	144°15'	10/11	0530	33.68	65.3	66.3
80	39°09'	143°50'	10/12	0530	34.11	68.0	70.0
82	38°21'	144°16'	10/12	1730	33.69	69.0	68.0
84	39°27'	144°12'	10/13	0530	33.67	62.1	65.0
-	39°43'	144°01'	10/13	1800	34.14	65.3	60.9
-	40°32'	144°15'	10/14	0530	33.91	63.7	57.8
86	40°29'	144°34'	10/14	1730	33.60	63.7	57.5
88	41°23'	144°38'	10/15	1730	33.42	63.0	64.0
90	42°54'	144°33'	10/16	1130	35.04	61.7	63.6
92	44°02'	144°48'	10/17	1730	32.90	57.7	57.3
94	45°04'	144°52'	10/18	1730	32.83	53.9	54.4
98	48°08'	144°28'	10/20	2330	32.78	49.5	48.7
101	46°09'	145°00'	10/21	0655	32.75	52.6	51.9
102	45°19'	144°37'	10/22	1730	32.77	53.3	56.0
104	43°40'	143°57'	10/23	1750	34.90	55.5	54.6
106	42°24'	148°52'	10/24	0530	35.03	60.6	62.6
107	41°07'	143°57'	10/24	2330	33.37	62.3	59.5
108	39°40'	144°23'	10/25	1745	34.20	66.0	61.0
110	38°28'	144°14'	10/26	0530	33.96	66.1	63.2
112	37°36'	144°44'	10/26	1725	34.31	68.0	66.8
115	37°04'	144°53'	10/27	0530	34.51	69.2	70.1
117	35°50'	145°21'	10/27	1645	33.26	70.4	71.2
120	35°17'	145°31'	10/28	0530	34.78	70.2	70.8
122	33°56'	145°51'	10/28	1730	35.41	71.2	72.0
124	37°40'	146°09'	10/29	1130	35.43	73.2	72.1
126	30°59'	146°45'	10/29	1745	34.31	74.0	73.7
128	30°15'	147°00'	10/30	0530	35.67	73.2	72.3
130	28°24'	149°52'	10/30	2330	35.74	74.1	73.2
132	27°08'	150°52'	10/31	0530	35.54	74.8	73.0
134	26°04'	152°10'	10/31	1735	35.25	75.0	73.5
136	24°52'	153°33'	11/1	0532	35.17	74.2	73.0
138	23°40'	155°00'	11/1	1730	35.23	74.9	74.9

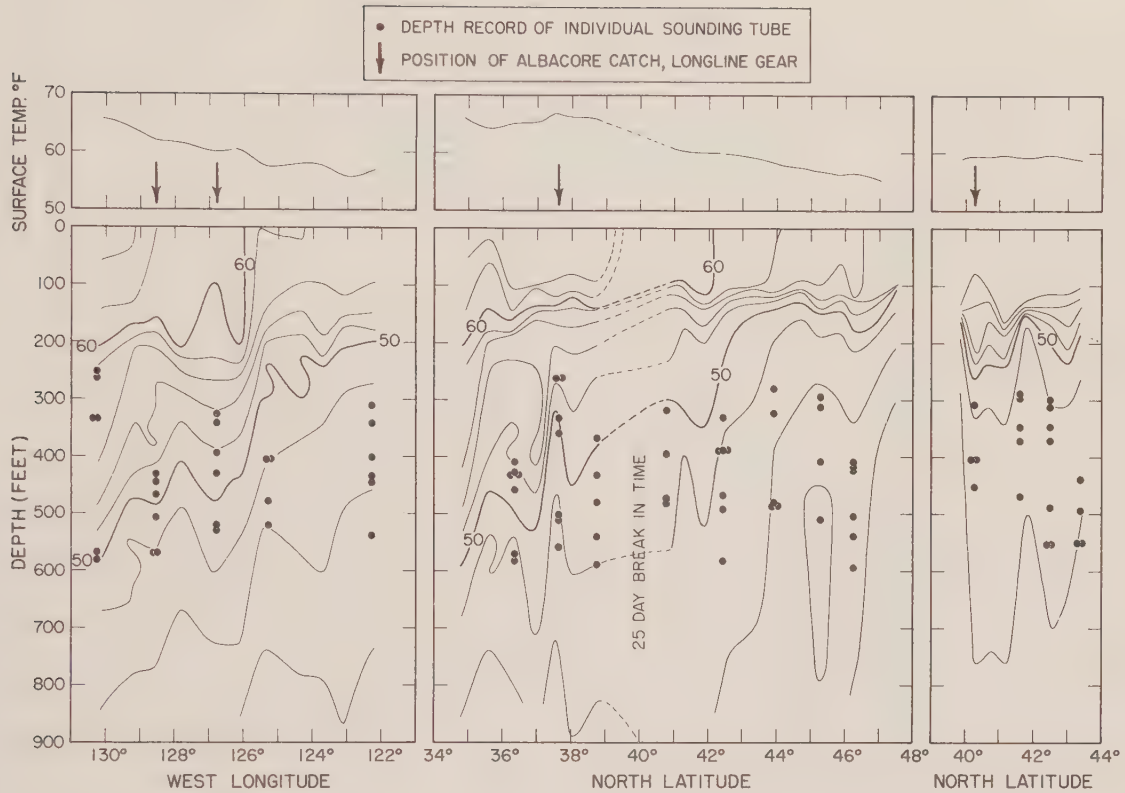

Figure 5 Figure 6 Figure 7

Figure 5.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 35°N. latitude; John R. Manning (cruise 26), July 15-September 10, 1955 (track shown in fig. 2).

Figure 6.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken running southeast and northwest between longitudes 130°W. and 140°W.; John R. Manning (cruise 26), July 15-September 10, 1955 (track shown in fig. 2).

Figure 7.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken running southwest between longitudes 127°W. and 129°W.; John R. Manning (cruise 26), July 15-September 10, 1955 (track shown in fig. 2).

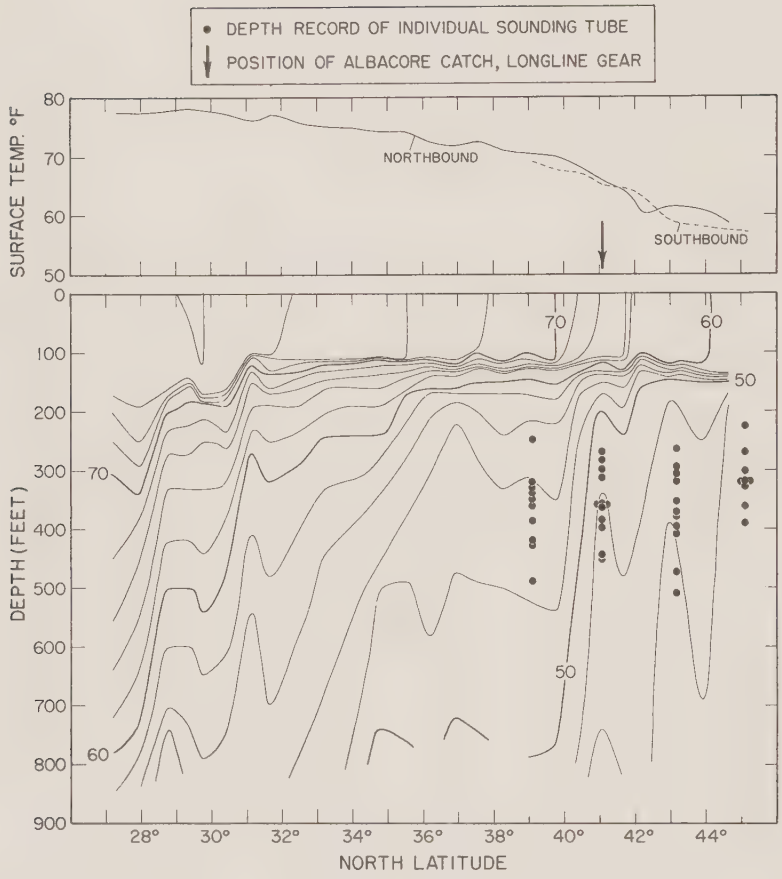

Figure 8.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 165°W. longitude; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3). The temperature-depth section was taken running north of 165°W. longitude and the sounding tube depths retracing southward. All of the bathythermograph slides of the latter run and some of those covering the northernmost region of the former were lost so that only the uncorrected data from the northward track remain.

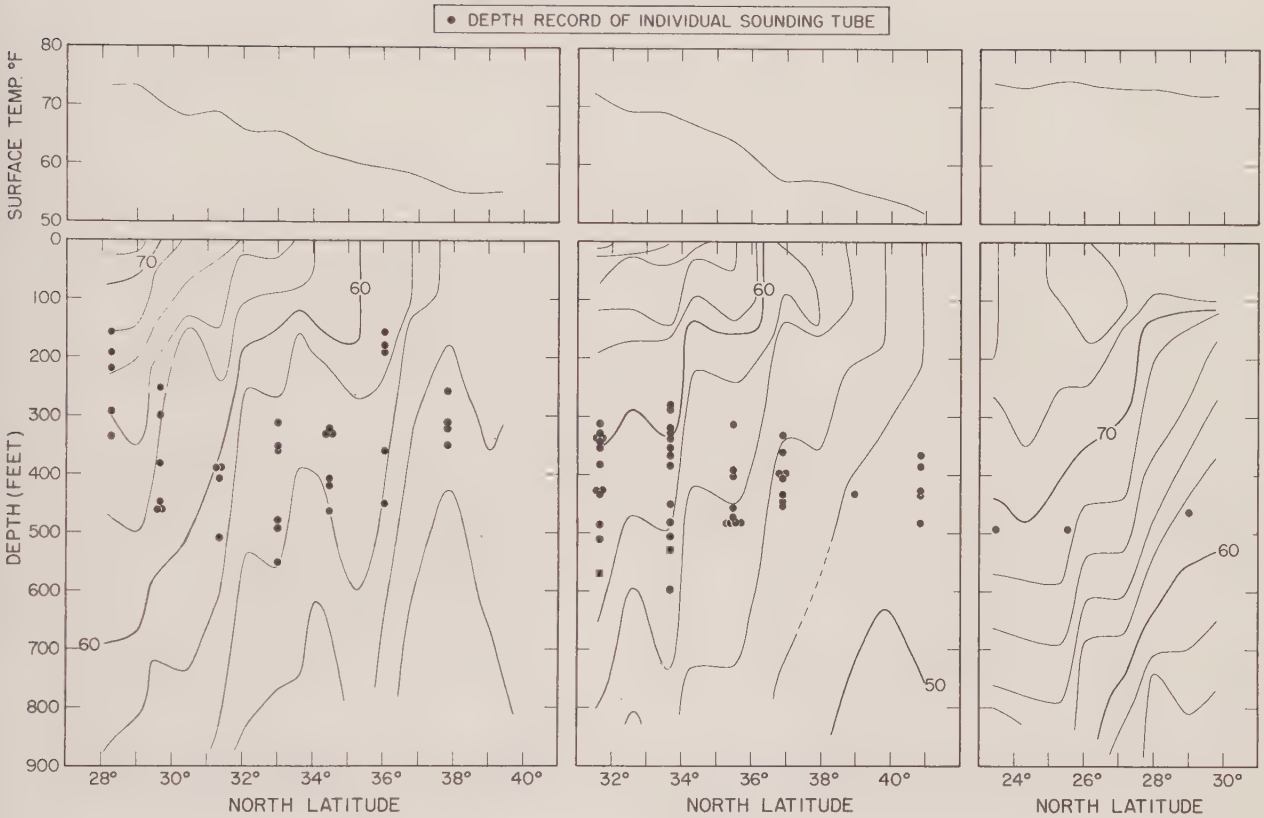

Figure 9

Figure 10

Figure 11

Figure 9. --Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 175°W. longitude; John R. Manning (cruise 25), May 2-June 7, 1955 (track shown in fig. 1).

Figure 10. --Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 165°W. longitude; John R. Manning (cruise 25), May 2-June 7, 1955 (track shown in fig. 1).

Figure 11. --Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 160°W. longitude; John R. Manning (cruise 25), May 2-June 7, 1955 (track shown in fig. 1).

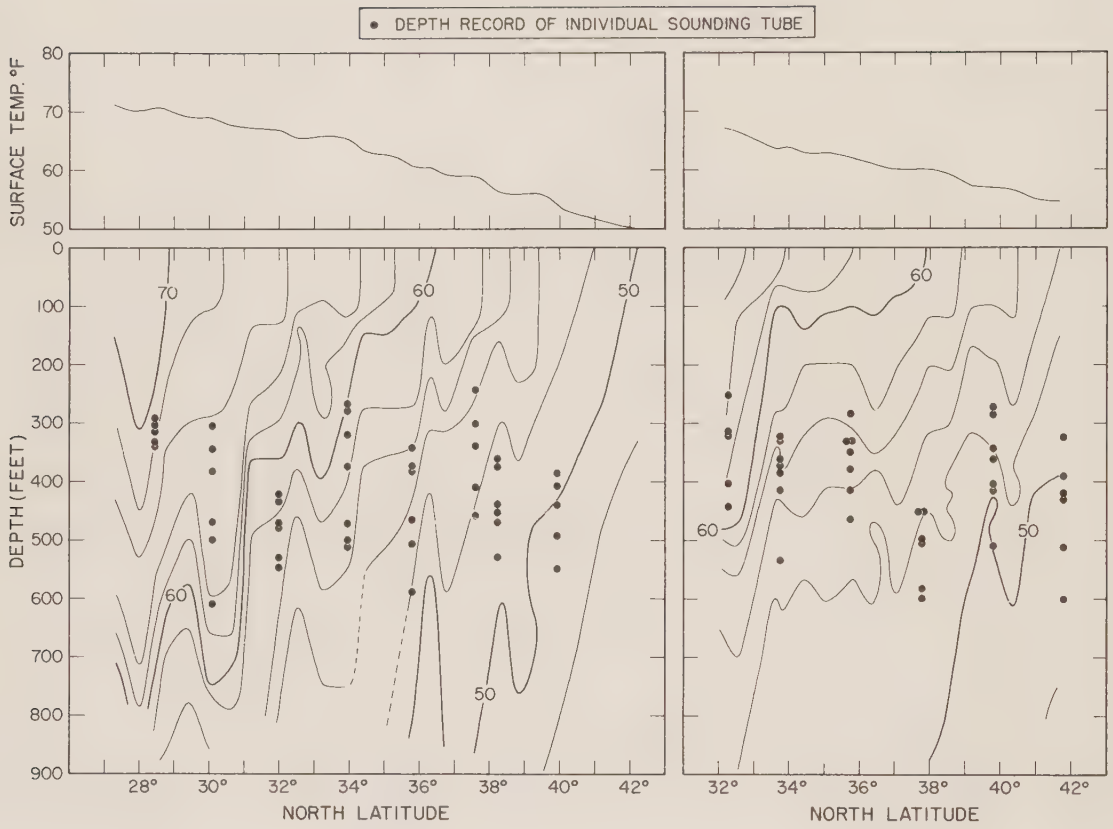

Figure 12

Figure 13

Figure 12.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 155°W. longitude; Hugh M. Smith (cruise 29), May 2-June 4, 1955 (track shown in fig. 1).

Figure 13.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 147°W. longitude; Hugh M. Smith (cruise 29), May 2-June 4, 1955 (track shown in fig. 1).

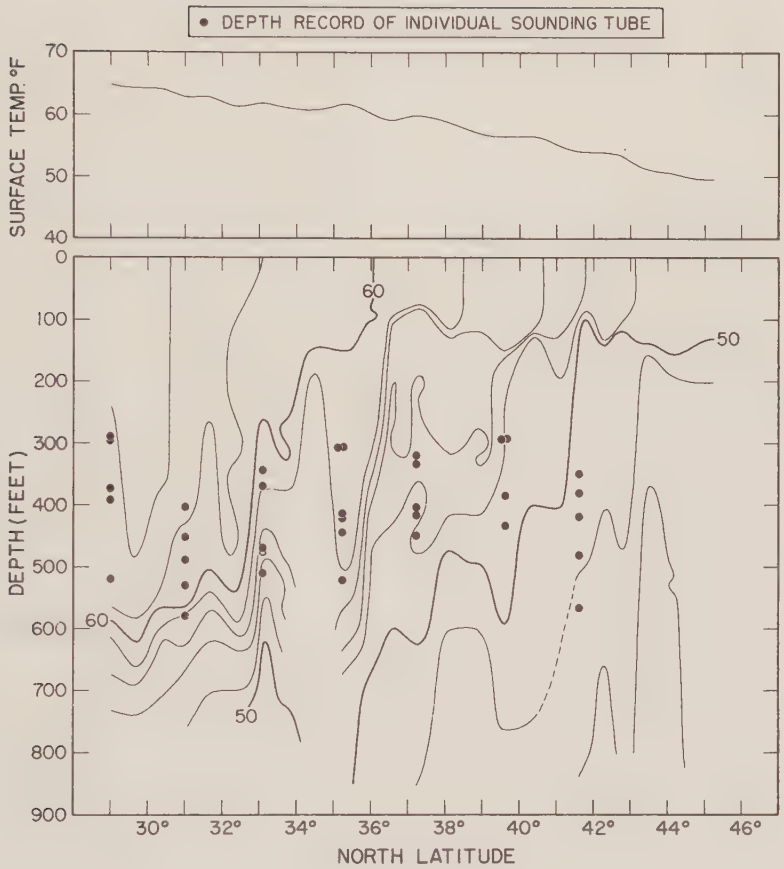

Figure 14.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken along 139°W. longitude; Hugh M. Smith (cruise 29), May 2-June 4, 1955 (track shown in fig. 1).

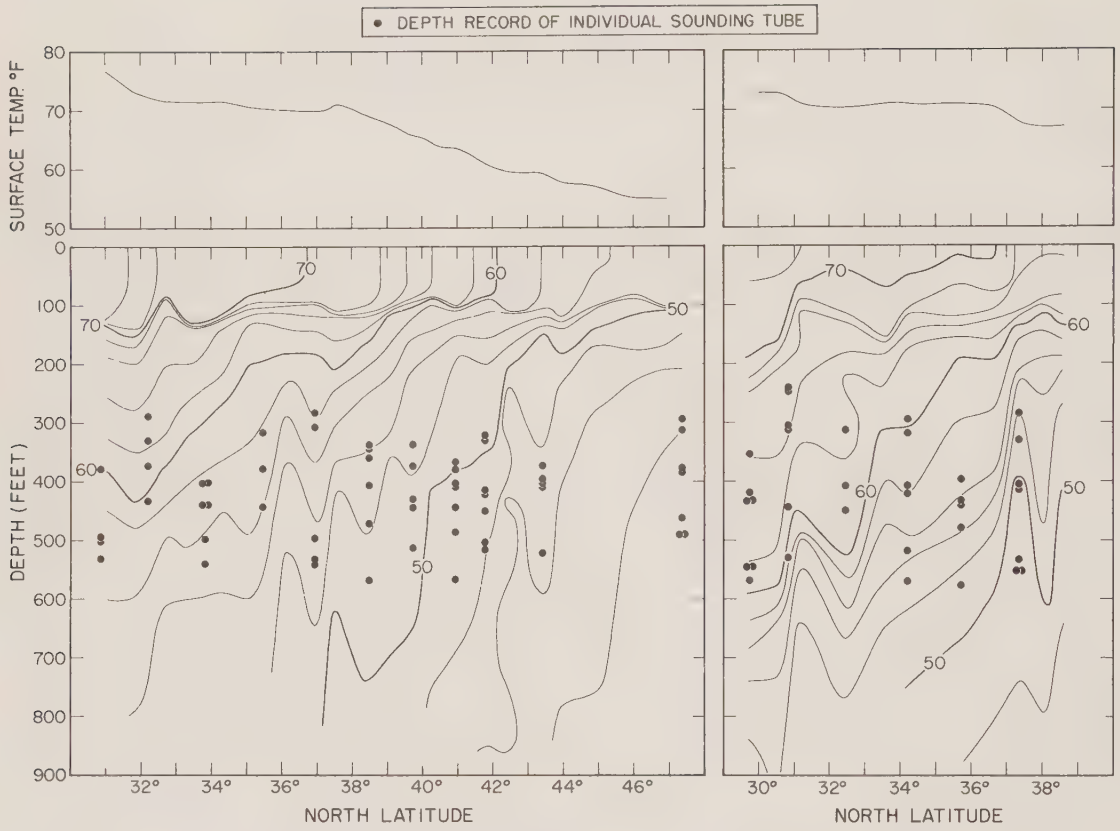

Figure 15

Figure 16

Figure 15.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken running northeast between longitudes 140°W. and 152°W.; John R. Manning (cruise 26), July 15-September 10, 1955 (track shown in fig. 2).

Figure 16.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken running southwest between longitudes 132°W. and 143°W.; John R. Manning (cruise 26), July 15-September 10, 1955 (track shown in fig. 2).

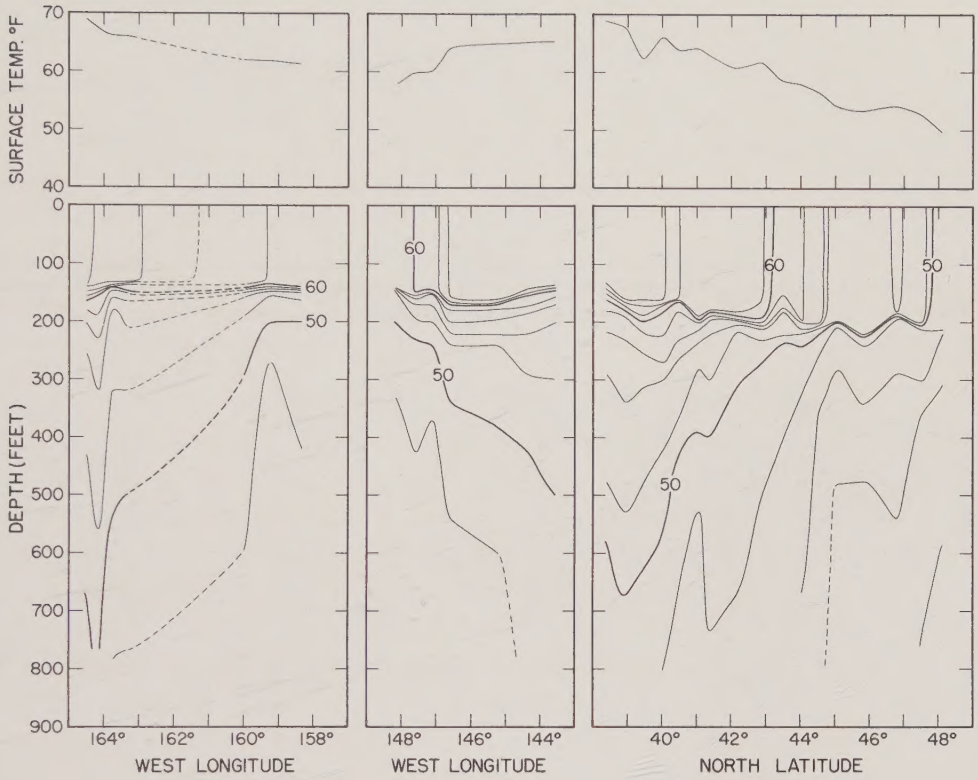

Figure 17 Figure 18 Figure 19

Figure 17.--Surface bucket temperatures (upper panel); temperature-depth section (lower panel) taken running northeast between longitudes 164°W. and 158°W.; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3).

Figure 18.--Surface bucket temperatures (upper panel); temperature-depth section (lower panel) taken running southeast between longitudes 148°W. and 143°W.; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3).

Figure 19.--Surface bucket temperatures (upper panel); temperature-depth section (lower panel) taken running north along 145°W. longitude; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3).

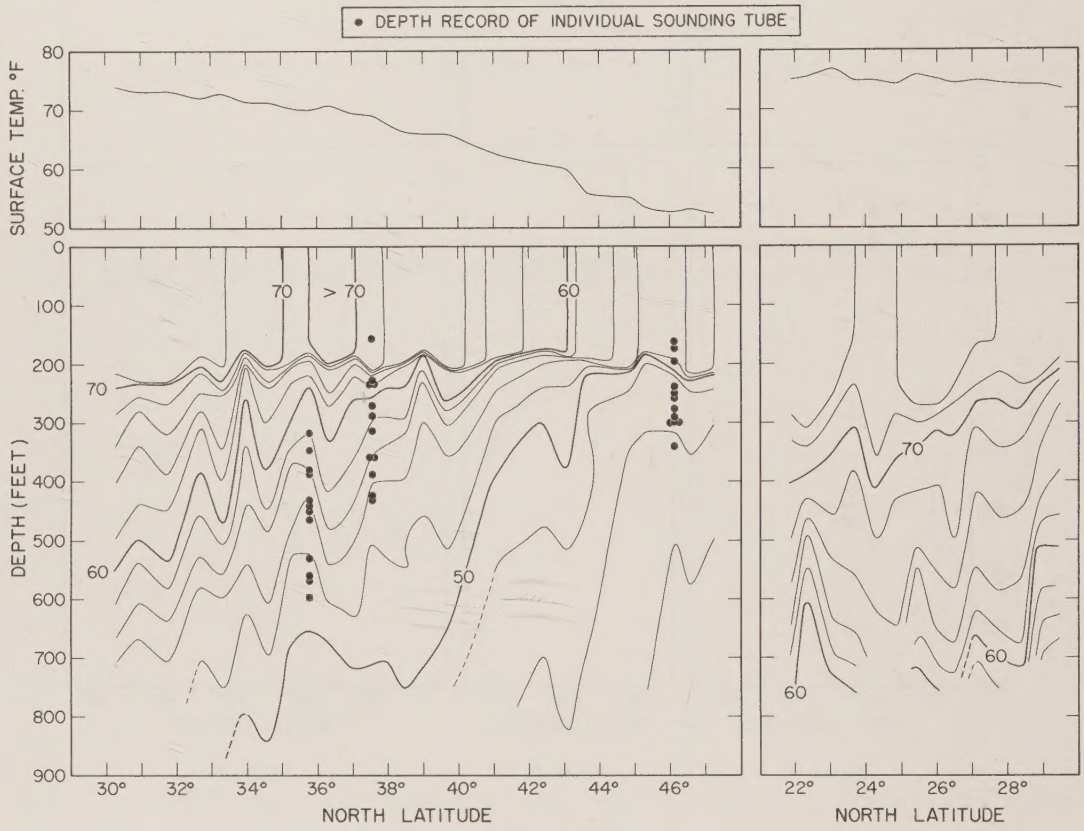

Figure 20

Figure 21

Figure 20.--Surface bucket temperatures (upper panel); temperature-depth section and sounding tube depths (lower panel) taken running south along 145°W. longitude; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3).

Figure 21.--Surface bucket temperatures (upper panel); temperature-depth section (lower panel) taken running southwest between longitudes 147°W. and 157°W.; Charles H. Gilbert (cruise 23), September 15-November 2, 1955 (track shown in fig. 3).